National Range Conference Proceedings

United States Department of Agriculture

National Range Conference Proceedings

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November 6-8, 1985

FOREWORD

The conservation and improved viability of America's rangelands--nearly 1 billion acres in all--and the economic health of the ranching industry concern us all.

As a nation, we have long depended on our rangelands for food and fiber. Yet rangelands have other functions essential to our well-being: they are watersheds, habitat for fish and wildlife, and sanctuaries of clean air. The beauty of these lands and the heritage of their industrious and caring people sustain us also.

Now, in the face of difficult economic and environmental problems, the United States must do more than cling to the traditional functions of range. We must look ahead to new opportunities--new traditions--for profitable and sustainable use of this resource.

The National Range Conference in Oklahoma City, November 6-8, 1985, called attention to opportunities for improving the management and productivity of rangelands. Ranchers, research scientists, environmentalists, educators, business executives, and government officials discussed many of the range manager's environmental and economic choices, as well as ways to reach rational, timely decisions. The recurring messages that you will find in this proceedings of the conference are--

- The private landowners who hold nearly two-thirds of the Nation's range resource deserve this country's gratitude for their responsible management of that resource. Their continuing guidance and cooperation are essential if we are to effectively transfer new technology and ideas from the laboratory to the land. Increasing cooperation and mutual respect among landowners and government range experts will do far more than any regulation can do to protect the rangeland environment.

- Range managers must stay attuned to needs and changes in the range ecosystem and adapt management accordingly. Brush management is a major ecological concern--as well as an economic one for many ranchers--because it affects production costs, soil resources, water quality and aquifer recharge, habitat for fish and wildlife, and recreation uses.

- Use of rangeland will become more diversified in the future. Forage for livestock will continue to be the primary use, but other uses (wildlife habitat, recreation, and crops for industry, energy, and food) will be economically desirable for the landowner, public land manager, and community.

- Strengthened research programs are needed, along with more practical and timely application of the research findings. Then landowners, land managers, and others can make informed choices on livestock and plant varieties, treatment options, marketing strategies, and assistance needs.

- Tax policies, international trade, and a number of other factors outside the agricultural sector influence the use and condition of range, the likely future demands on range, and the likelihood that range will be able to meet those demands.

- There is potential for conflict among all the uses of range or interests in range. Conflict can be minimized or resolved if the parties involved work hard at learning each other's points of view; help each other increase public understanding of the many values and needs of rangeland; and are open to modifying their own objectives or practices.

Range issues cannot be addressed by themselves. They need to be blended with other economic, social, and environmental questions if we are to achieve range strategies that are timely, cost-effective, and fair. The Department of Agriculture and nearly 60 other cosponsors of the Range Conference are committed to helping resolve these issues to the benefit of the rancher, the Nation, and the environment. We already are at work together on responding to the conference findings.

The papers in this volume reflect the commitment of the people who served on the discussion panels at the conference. We can all learn from their good business sense, their stewardship, and their vision of future opportunities for range and the people who depend on range.

JOHN R. BLOCK
Secretary of Agriculture

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Issued February 1986

KEYNOTE ADDRESS
By John R. Norton
Deputy Secretary of Agriculture

After wrestling over the farm bill in Washington the past several months, it's a real pleasure to come to Oklahoma--to the land of Will Rogers and his brand of common sense.

While listening to some of the debate the last few weeks, I have wondered if his kind of thinking had become a vanishing commodity in our nation's capital. That's why I enjoy meeting with a group like yours. It's reassuring to find there are people with common sense solutions to America's problems.

As a westerner, I can speak with some authority about America's love affair with the open range. After all, who doesn't feel at least a tingling of nostalgia when they hear familiar songs like "Home on the Range," "Tumbling Tumbleweeds," or "Cool Water."

But the problems we face in dealing with America's rangelands won't be solved by any "ghost riders in the sky." In fact, those nostalgic feelings are one of the first hurdles we must overcome.

Another hurdle deals with the transfer of technology. A lot of research has been conducted to improve range management. But, what's our scorecard when it comes to putting that research into practical application?

In addition, the farm bill will very likely contain some new challenges for range managers, not the least of which is what to do with land that could become part of a large conservation reserve. We need to think about its use while it's in a reserve--as well as how it will be used after any reserve contract expires. Therein lie the challenges--and the opportunities--which I know you will think about this week. By focusing on these challenges, I believe we can improve the use of our rangelands, strengthen our agricultural economy, and protect our environment--all at the same time.

Does that sound like a tall order? You bet it is! And that's why your first challenge is to help us better define all the benefits from well-managed rangeland.

In many ways, the open range is America's forgotten resource. In spite of the songs, it has never received the attention nor the credit it deserves as a vital part of our nation's economic complex. Likewise, the stewardship by the owners and managers of our grazing lands also has gone largely unrecognized.

That is why we made this conference a joint project--bringing together not only several agencies within the U.S. Department of Agriculture (USDA), but also other federal agencies and a broad base of outside organizations. Together, we can begin to change public attitudes toward one of our most critical natural resources.

Think about it: More than one-third of our country is rangeland--public and private. Two-thirds of our states encompass at lease some range, and the products from that land are the single greatest economic resource in several states.

Besides sustaining the bulk of our nation's livestock industry, America's grazing lands also provide:

- Habitat for thousands of species of wildlife, including some 9 million big game animals.
- Clean water for farms and cities, through the natural filtering process of rain soaking into the ground and running off into rivers and lakes.
- And, recreation and scenery in abundance--whether your interest is hunting, fishing, hiking, or just plain finding a quiet place to relax outdoors.

To put it bluntly, America's rangeland sustains the livelihood for millions of American families. That means we all have a stake in protecting this valuable resource.

Now that we have defined the obvious benefits, let's go a step farther. Let's start by

projecting our thoughts around the concept that diversification of range uses will be the order of the day by the turn of the century.

The major use of rangeland surely will continue to be forage for livestock. After all, it's the foundation for our nation's meat supply. But new opportunities increasingly will arise in a growing economy to use this resource in other, less traditional ways.

These uses need not compete with the livestock industry. In fact, we envision them complementing ranching, increasing the value of the resources and helping improve the economic climate for an important segment of our economy. For example, I'm confident we have yet to tap our rangelands for the production of nontraditional crops with industrial as well as food potential.

I am amazed, for instance, at how the once lowly mesquite bush is being turned into a gold mine for those who savor their barbeque flavors. And, I know many ranchers are finding new sources of income from commercial wildlife ventures, as our growing population demands more hunting and fishing opportunities.

That brings me around to my second challenge to you--technology transfer. The U.S. Department of Agriculture has been in the business of range research and education since the turn of the last century. Much of today's basic range science has evolved from early techniques developed in our national forests. And, frankly, I think we've got a pretty good track record.

But that's not the point. Range research, and the transfer of this technology, must become as dynamic as the basic resource itself. Our efforts today are varied. Not only are we conducting research at several USDA installations, we also are supporting research at many of the state agricultural experiment stations.

Further, we are cooperating with the Department of Interior's Bureau of Land Management. But that's another, different topic which I will leave to Secretary Hodel.

Among USDA's research efforts, we are developing computer models that simulate the dynamics of rangeland. We are compiling computer data bases that will help us predict soil conditions under various methods of management. We are analyzing different ways to control brush and studying better methods to re-establish desirable plants on deteriorated range.

Further, we have determined through research on the diets of cattle and deer that they can live well together on the range, since they tend to eat different plants. We have developed new ways to improve forage on all kinds of rangeland through a variety of approaches--prescribed burning in some cases, and new grass varieties in others. The list goes on and on.

But research has little value unless we can apply it. That is why we have helped sponsor such cooperative projects as the annual International Ranchers Roundup in Texas; the Public Lands Council Riparian Management Workshop in Denver last month; a state range stewardship program in Wyoming; and a range simulator in Montana that teaches future ranchers, conservationists, and consumers about agriculture's use of natural resources.

But we'll all need to do even more. And, we need to ask some tough questions. Are we doing the right kind of range research? Who are we doing it for? Are we really answering the needs of the range community? And are we doing enough to transfer our new-found technology from the laboratory to the land?

Last but not least, we face the challenge of what to do with land that may be committed to a conservation reserve under the new farm bill. I'm sure you are aware of the rationale behind this section of the bill. I believe this is one of those rare opportunities when enlightened leadership can do this nation one of its greatest services in many decades.

Years ago, some landowners--predominantly absentee owners--found it was profitable in the short run to plow out fragile rangeland. They planted crops so the land would qualify for price supports and crop

insurance--as well as increase its resale value. The trouble is, those actions ruined the land.

So, one section of the farm bill would deny federal farm program benefits to landowners who, in the future, are inclined to plow out certain erodible grasslands--unless they follow an approved conservation plan in doing so. As I'm sure you know, this is the so-called "sodbuster" provision of the farm bill.

A companion section would encourage the retirement of some 20 to 30 million acres of highly erodible land--much of which probably should never have been touched by the blade of a plow. This is the conservation reserve. Producers with eligible land would bid to enroll it in the reserve for a specified period of time--probably 10 years.

The immediate challenge is to decide what could be done with land committed to this reserve. Much of this land would revert to range and native pasture.

One school of thought is that no products should be harvested from this land as long as it is under contract in the government reserve. In essence, grazing, raising hay, or harvesting timber would not be permitted.

Another, longer-term concern is what should be done to ensure this lands stays out of production after the 10-year term of the reserve. While presumably the "sodbuster" provisions would still be in force, what's to prevent some landowner from disdaining farm programs to turn the land back into other crops?

We don't have all the answers. But I can assure you that we do have the commitment to effectively manage this great, national, renewable resource we call our open range. And, to succeed, we must have your ideas and your help.

Like Will Rogers once said, "It's a great country, but you can't live in it for nothing."

SPECIAL ADDRESS
By Donald P. Hodel
Secretary of the Interior

I appreciate Jack Block's providing this opportunity to be with you. I am sure you will agree that he is doing an outstanding job, under very difficult circumstances. Together, our responsibilities for the public range make close cooperation between our agencies a must. Fortunately, we share the privilege of serving a President who understands these issues . . . who is a rancher himself.

When I was nominated to be the 45th Secretary of the Interior, the President gave me five goals:

- Preserving the Nation's national park, wilderness, and wildlife resources;
- Enhancing American's ability to meet our energy and mineral needs with domestic resources;
- Increasing the supply of quality water resources;
- Improving the federal government's relationship with state and local governments; and,
- Developing the economic and social resources of American Indians, Native Americans, and the people of the U.S. Territories.

It is readily apparent from these objectives that there is an inherent opportunity for conflict within the Department. I make reference to a tract of land: the National Park Service (NPS) wants to make it a park; the Fish and Wildlife Service (FWS) wants a refuge; the Bureau of Reclamation (BuRec) wants to dam it; the Bureau of Land Management wants to graze it: the Bureau of Indian Affairs owns it. Therefore, when I took this job, my goal was to build a national consensus on the broad policy matters within the jurisdiction of the U.S. Department of the Interior (DOI). I hope to seek consensus through involving all sectors--public and private, development and conservation. Certainly this is one of the major objectives of this conference.

We at Interior have a role at this conference primarily because of the Bureau of Land Management's range responsibilities. The United States has nearly 1 billion acres of range--one-fourth of which is federally owned and managed by the Forest Service and Bureau of Land Management. BLM manages more than 170 million acres of rangeland in the western United States. These lands provide forage for 4.3 million head of livestock, about 56,000 wild horses and burros, and 2 million big game animals. Public rangelands suitable for grazing are currently under permit or lease to 20,300 livestock operators. In many areas, livestock graze under the shadows of oil derricks or adjacent to active coal mines. In addition, these public lands provide a playground for millions of Americans interested in camping, hiking, off-road vehicles, hunting, or just in getting away from it all.

Perhaps one of the most visible measures of the success of President Reagan, who really does understand because he is a westerner and a rancher, is the history of the Sagebrush Rebellion--or more appropriately, that the Sagebrush Rebellion is history. When President Reagan was elected in 1980, one of the most critical issues confronting him in the West was the Sagebrush Rebellion. At that time, federal management of our public lands was not well accepted, particularly by neighboring private landholders. Just 5 or 6 years ago, federal land managers couldn't go out on the range without a firearm or a bodyguard, for fear of bodily harm. Today, the clamor to turn federal lands over to local and state governments or private ownership is history. Why? The federal government stopped being a callous, arbitrary force out here in the West. Department of Interior staffs have instead been directed to be good neighbors--to practice cooperation and not confrontation--and that's what most of them wanted to do anyway. We have increased cooperation between BLM and the U.S. Forest Service and that interchange has been very helpful. We have worked together on the possibility of trading lands for more effective

management, and on sharing office headquarters where it would save federal dollars.

The fundamental problem now is that people do not want to lose the relationship that they have established with the local BLM or FS land managers. That simply adds to our success story. BLM had a Cooperative Management Agreement (CMA) program to involve many others in our stewardship responsibility, in order to replace confrontation with more local control in our day-to-day management. We believe we were successful in improving the management of federal range. We did so by involving recreationists, wildlife groups, ranchers, State and local agencies and others in public land management; and by sharing responsi- bility with BLM for maintenance, protection, development and enhancement of the resources.

However, we were sued over this issue and lost.

We have decided not to appeal the Court's recent ruling on CMA's, because we believe we can achieve the objectives of the program faster by administratively correcting the errors found by the Court than by further litigation.

One of the avenues at our disposal is to amend the existing regulation to ensure that it cannot again be misinterpreted by a court. The court's finding in this case was that under CMA's, we would give livestock operators unfettered authority to manage the federal range. We don't do that, and we won't permit it, but we will give the livestock operators the flexibility to manage grazing allotments more efficiently and productively. We will give incentives for private investment in range improvements, and we will ensure the environmental protection and productive management and use of public rangelands for generations to come.

We believe in cooperating at the resource planning stage, as well as the management stage. BLM calls the process coordinated resource management planning. In this process, potential adversaries such as livestock producers, wildlife agencies and organizations, and other resource management agencies and organizations interested in public land values join in detailed planning for the management of specific areas. Conflicts are dealt with openly and are resolved. Land use management decisions are reached by consensus. A level of trust and confidence among the participants is established through face-to-face discussions, creating an atmosphere that is conducive to conflict resolution.

We now are expanding this form of conflict resolution outside the experimental stewardship areas. A national level Memorandum of Understanding involving those federal and state agencies with interests in public land coordinated resource management planning has been in effect for several years. Every BLM District in the State of Nevada, for example, has a standing coordinated resource planning committee comprising persons representing the various multiple-use interests. Other States are equally well organized.

We also are continuing our traditional methods of securing range improvements through cooperative arrangements with federal permittees and lessees. We are trying to increase the level of private investment with any incentives available. And we are trying to recognize the many contributions of private land managers. Together, they can be more efficient than large bureaucracies.

Inherent in the success of our management of the public range is recognition of the many contributions private land owners make to this system. The Reagan Administration both recognizes and appreciates the efforts of the private land owner.

All too often, the public views the Nation's range resources as entirely publicly owned. They are wrong! There is a lack of understanding not only about the extent of private ownership but also about the extent of the contributions those owners make to wildlife habitat, riparian areas, and resource improvement. The private rangeland owners are integral to this vast resource system--their contributions are real contributions.

For continued success and continued improvements of our land management, we must have a real working partnership between the public and private sectors. It is in this area we hope the Reagan Administration has brought real and productive change.

One new Department of Interior initiative is a public awareness campaign, "Take Pride in America." It responds to the problem of vandalism and theft on public lands. This problem was almost unheard of only a few generations ago. Ours was an agrarian-based society then. If we weren't on the farm, we were from the farm or had relatives on the farm. We were, as you in the range community still are, acutely aware of the importance of stewardship, of the importance of taking care of the land so it would take care of us: "As ye sow, so shall you reap." Today, however, many in our urban society have forgotten or have never learned about the importance of trying to leave the land better for those who follow.

The federal government manages over 700 million acres of public land--about one-third of the total U.S. land mass. With our growing population, more leisure time and greater mobility, it is inevitable that these public lands will be subject to increasing use. If we are to ensure these lands are protected <u>for</u> Americans rather than <u>from</u> Americans, we will need greater public awareness of the importance of wise, careful and respectful use of these lands.

Fortunately, most American do care...and care deeply. But too much land and too many resources have been carelessly vandalized, looted, or burned. Many of these resources (natural wonders, historical and cultural sites) are irreplaceable.

Public land managers (federal, State, and local) across the Nation are trying to respond to a real need for citizen and community involvement and education to address this problem. So, at Interior, we are developing a national public awareness campaign that can serve as an umbrella effort for such initiatives. We want to encourage Americans in all walks of life to recognize their stewardship responsibilities and to share that knowledge with others by speaking out at local civic group meetings, organizing educational fie trips, reporting harmful activity on public land and on and on. There is no limit to what people can do!

Range people are among those who can help significantly. You are knowledgeable. You can help us a great deal. Please give us ideas on what to say, where to go, what to do. We do wan a community-based program, not a massive federal program. We are developing a special awards program to recognize existing efforts and inspir new ones.

The American Camping Association is very interested, as just one example. There are nine million people who camp every year; yet the Association has had no camping etiquette program It is going to start one now. If we can reach nine million people every year in this way, the "Take Pride in America" campaign will be a succe

All of American's parks face the same problems, and they have all gone at the problem piecemeal. We need to get across to more Americans that thi land is <u>their</u> land.

There is a good history of cooperation between range people and public agencies. Let's encoura more of our fellow Americans to work together to improve the resource base, to set aside conflict that are causing us difficulty, and to establish some consensus.

Together we can reach the goals that we all want for America.

CONFERENCE OVERVIEW

OVERVIEW OF THE RANGE RESOURCE

By Gerald W. Thomas[1]

Yesterday --

- o The stock market hit an all time high
- o The Federal Deposit Insurance Corporation continued negotiations with more troubled banks
- o Agriculture Secretary Block stayed in Washington to testify on a new farm bill
- o New Mexico State University released a study showing that the cost of raising a beef animal in our state was $20 more than the selling price

What does all this mean to those of us interested in range resources? It means we have to address a myriad of problems, both economic and ecological. I hope this National Range Conference will provide some of the answers.

Echoes of the Ecos

The sub-title of my talk could be, "Echoes of the Ecos." Echoes are reverberations of waves, repercussions of events, faint sounds of the past that we still hear over and over again.

The "Ecos" of which I speak are "nomics, "logy," and "tone." Eco-nomics, eco-logy, and eco-tones. "Eco" comes from the Greek word "Oikos"--meaning house or home. Originally "economics" was home management or orderly management of the household or business. "Ecology" is a derivation of "Oikos-Logos" or home logic--now meaning the totality of relations between organisms and the environment. "Ecotone" is the transition area between two biological communities. So, it should be clear, there is not one, but really three types of "Eco-freaks"--ecology types, economics types, and those that ride the fence or can't tell the difference.

As I look back at the last few centuries of our history--and more specifically at the 6-1/2 decades of my lifespan, it is clear that the echoes of economics are more pervasive and louder than the echoes of ecology. Perhaps this will always be true, given the nature of humankind. Will and Ariel Durant (1968), in their several volumes on "The Lessons of History," state it this way:

> "Nature smiles at the union of freedom and equality of our utopias. For freedom and equality are sworn and everlasting enemies, and when one prevails the other dies....We are all born unfree and unequal...diversely endowed...."

Furthermore, the Durants emphasized that we all like to compete. Competition is the basis of our so-called free enterprise system. Competition enhances individual performance. Highlighting this is the feature story in the September 1985 issue of "Time" under the headline "China: Moving Away from Marx." That story quotes Chairman Deng Xiaoping as saying, "So what we have done is adopt the useful things under the capitalist system...to our planned socialist economy" (Time 1985). This second revolution in China illustrates the impact of competition and economic incentives. After all, without the incentive to produce, we cannot survive economically as a nation. However, without the incentive to conserve, we will likely sacrifice the resource base on which all future generations must depend.

Most new books that analyze the past and trends for the future are really statements about economics. In "Megatrends", John Naisbitt (1983) outlines 10 new directions that are shaping our lives. All of the megatrends identified by Naisbitt are driven by economics. Some mention, of course, is made of social and religious forces, but these are considered minor. The brief mention of environmental concerns was to note that ecology was "a passing fancy," replaced in the news by the Civil Rights issue.

1/ President emeritus, New Mexico State University, and consultant, Consortium for International Development.

I am not trying to downgrade "Megatrends". Everyone should read the book. Everyone can see these economic forces. However, for the ecologist or the geologist, the trends Naisbitt is talking about are short-term and not long term and they ignore most basic relationships between man and the geosphere and biosphere.

In their book "In Search of Excellence," which is about economics and business know-how, authors Peters and Waterman (1982) learned from their study of America's best-run companies that "...the excellent companies were, above all, brilliant on the basics." These basics were:

- o Tools didn't substitute for thinking
- o Intellect didn't overpower wisdom
- o Analysis didn't impede action
- o Some chaos was allowed in return for quick action

I like that last idea: To allow some chaos is often necessary to attain business success. To allow some chaos is also necessary to run a university, as I found out the hard way. And, those ranchers gathered here today understand that some chaos is an unavoidable part of their operations, regardless of whether their concerns are economic or ecological.

At this point, I should clarify my concepts of ecology. Ecology is a legitimate field of science--not a concept of environmental protection. Range Management could be called "applied ecology." I'm not an emotionalist, but a concerned conservationist. I'm not a protectionist, but an environmental manager. And I'm not a gloom-and-doom forecaster, but an individual trying to read the lessons of nature.

I believe in the axiom, "Never does nature say one thing and wisdom another." But, to let nature take its course in a protectionist atmosphere will neither benefit mankind nor maintain the values we are trying to protect. As a charter member and past president of the Society for Range Management, I have said many times that I'm glad we named our organization the Society for Range Management and not the Society for Range Protection. Ecological understanding, research, and management orientation are essential as we attempt to properly utilize the range resource.

I ask you to keep in mind the continuing "Echoes" of the two important "Ecos" as I proceed with this overview. We cannot ignore either "economics" or "ecology" as we examine the past and plan for the future.

Nature and Extent of the Range Resource

About half of the earth's land surface is range or permanent pasture. Grazing by livestock and certain species of wildlife is the most important land-use practice. The United States has about 855 million acres (346 million hectares) of rangeland with an additional 363 million acres (147 million hectares) of forested range and permanent pasture (Schuster 1984). Over a billion-acre resource! Most of this rangeland is not adapted to intensive land use because of rough topography, severe temperatures, or poor soils; but the predominant factor limiting production is lack of moisture. The cost of energy has also become a major constraint to increasing food production from these lands.

The total contribution of rangelands to world food production is very high--perhaps greater than most statistics indicate. This contribution to food supplies is both direct, in terms of the production of livestock products and some plant materials, and indirect, since vegetation management affects water yield, biological stability, and environmental values.

Most of the world's 1.2 billion cattle and buffalo, 1 billion sheep, and 400 million goats spend part of their lives on rangelands. Although forage production on rangelands is seasonal, it is estimated that U.S. grazing lands supply the year-round forage equivalent for 35 million cattle (Winrock Int. 1978).

The vegetation complex as we know it today evolved under millions of years of grazing pressure by various species of wildlife. Many of these wild

animals on each continent were ruminants that practiced selective grazing. Undoubtedly, they influenced the vegetation composition and shaped the plant communities. The balance of nature on most range areas was accomplished not by smooth and easy changes but by erratic cyclic patterns in both forage production and wildlife populations.

With domesticated livestock, mankind changed the relationship between animals and the vegetation base. Some of the normal curbs to population control are no longer in place. Consequently, an understanding of range management and animal husbandry has become the ecological key to sustained range livestock operations.

Implications of Ownership

The land ownership pattern is a major consideration in the management and use of all range areas. In the United States, approximately two-thirds of the rangelands and over three-fourths of the forest lands in the contiguous states are in private ownership (Harris 1980). Understandably, these private ranges are managed first to satisfy the needs and desires of the individual owner. Except for local zoning ordinances and laws relating to public health and safety, these owners are seldom constrained in their management decisions. Surveys show that many private rangelands, even without outside controls, are in fair to good condition and that many private operators are managing their ranches for multiple use.

A very high percentage of the total area of many states is owned or held in trust by the federal government. Nevada has the highest percentage of federal land (89 percent), followed by Utah with 74 percent. Over one-third of the land in each of the eleven western states is under federal control.

The Bureau of Land Management now has responsibility for about 482 million acres (195 million hectares) in the United States; the Forest Service, 186 million acres (75 million hectares); the National Park Service, 28 million acres (11 million hectares); and the Fish and Wildlife Service, 27 million acres (11 million hectares). In spite of these vast holdings by the federal government, private lands in the 17 western states still constitute 63 percent of the total area. State ownership is now approximately 5 percent of the total area. Public lands, in contrast to private lands, are directly affected by federal and state laws and regulations relating to land use.

The Bureau of Land Management and the Forest Service, the two largest federal land managing agencies, are required to manage the public lands they administer in accordance with multiple-use principles and policies. The primary management objective is to satisfy the requirements and needs of "society." On public land, livestock grazing is recognized as one of the multiple uses, but the livestock must be managed so that the other values of the land can be maintained.

Multiple Use Concepts

Multiple use of the range resource has been accepted and practiced for many years. Although the primary income may be from livestock or forest products, the lands also are important for mineral production, wildlife, recreation, and water yield.

For economic analysis, we can classify multiple use of range resources into three categories: competitive, supplementary, and complementary. The traditional viewpoint of the rancher is that all other uses tend to compete with livestock production. This is certainly true for many ranching enterprises. But, for others, it may be both economically advisable and ecologically sound to consider supplementary or complementary activities such as grazing two or more classes of livestock, producing game, and managing the resource for recreational purposes.

Furthermore, while the rancher, as an individual with direct economic interest in the range resource, may desire single-use management, the public must always consider multiple use as the most desirable approach. As people come more and more to realize the impacts of man's land-use practices on the total environment, the concept of multiple-use management becomes even more important.

Range Condition and Trend

Vegetation on rangelands is the key to both livestock productivity and environmental stability. Range management should be oriented toward maximizing primary plant production as well as increasing the diversion of plant biomass to mankind.

For the past 45 years, I have been observing vegetation change in the West and trying to keep up with the literature on range condition and trend. I see vast improvement on most range lands since the 1930's--including the Idaho range where I was raised. This observation is supported by the national assessment of range condition and trend in the United States conducted in accordance with the Resources Planning Act of 1980. It is also supported by data presented last year at the symposium celebrating the 50th anniversary of the passage of the Taylor Grazing Act (Thomas 1984). However, range improvement takes time, particularly on semiarid lands. And we have plenty of room for improvement.

The Range Livestock Industry

To plan for the future, we need to know something about the present status of the livestock industry. Cattle rank first among the animals contributing to human welfare. India still leads the world in total numbers (242 million), followed by the Soviet Union (117 million) and the United States (115 million).

World sheep numbers are estimated to exceed 1 billion head. The Soviet Union leads with 140 million head, followed by Australia (133 million), New Zealand (71 million), Turkey (50 million), and India (42 million). The U.S. sheep population has slipped to thirteenth in rank.

In the 17 western states, Texas leads in cattle numbers with over 11 million head, followed by Nebraska, Kansas, South Dakota, and California. Texas also leads in total stock sheep, with over 2 million head, followed by Wyoming, California, New Mexico, and Montana. And Texas leads in goat production.

If the economic pressures continue on our ranching operations, these world and national rankings could change substantially. Ranchers in the United States are in more financial trouble today than at any period in our history since the Great Depression. And that fact, I'm sure, is one of the major reasons for the call issued for this conference. Cattlemen today are asking us to respond to the questions, How can we make a living from our range resource? and, What is our future in range livestock operations?

The Challenge Ahead

I want to make some generalizations about the challenge ahead.

(1) Economics will continue to be the driving force for decisionmaking. The economic forces are no longer just local or national. To an increasing extent, it is the international dimension that is shaping our costs and our opportunities for income. For the past several years, I have had the privilege of serving on the board of directors of the Federal Reserve Bank of Dallas (El Paso Branch). During this period, I have seen reports on the control of inflation, the struggle to lower interest rates, the international balance of trade, the national debt, and the impact of the high value of the dollar.

The western livestock industry has been materially affected by these national and international trends. A few years ago, inflation seemed to be our number one problem. I credit the tight monetary policy of the Federal Reserve Board with bringing inflation under control. And now, several other economic problems have emerged which demand our attention. Preston Martin (1985 a, b), vice-chairman of the Board of Governors of the Federal Reserve System puts it this way:

> "...International trade and capital flows have played an increasingly important role in the behavior of the U.S. economy and financial markets.
>
> ...Both the trade deficit and the current account deficit this year will set new records.

...If recent trends continue, we will soon become the largest debtor nation in the world.

...Several policy actions have been proposed to bring down the trade deficit. One is for the Federal Reserve to follow a significantly more expansionary monetary policy. But aggressively, inflationary growth of money and credit to bring down the dollar's exchange rate would not enhance the position of U.S. firms in world markets. A lower external value of the dollar would be offset by inflated domestic costs.

...One major result of the growing trade deficit and the pain it has inflicted on major sections of our economy (including agriculture) has been the growth in protectionist sentiment in the country. More than three hundred bills have been introduced in Congress to raise trade barriers.

...Although understandable from a political viewpoint, the growing protectionist fervor is profoundly disturbing. The possibility of a trade war is a major risk to global growth."

These are only a few of the statements that underline the power of economics at the international level. The closure of banks and savings institutions has passed the peak of the Great Depression (Short 1985). Agriculture has joined with energy and real estate to help bring about the downfall of many of our financial institutions. Even the Farm Credit System is seeking a multi-billion-dollar bail-out to salvage their credit relationships with about a third of the Nation's farmers and ranchers. We borrowed money on land that was overpriced in relation to its income-producing potential and we did not anticipate the loss of markets due to imports and the changing diets of the American people. My concern now is that credit institutions will over-react and marginal farmers and ranchers who could survive may not get the chance because of credit cutoffs. Some recommendations:

- We must become more consumer and market oriented. We can't expect results from our campaign to "eat more beef" unless we tell a health-sensitive consumer why.

- We must become better business managers--alert to the impacts of national and international trends and policies. The businesses that have prospered during the last decade were cost conscious; they knew at all times what their bottom line trends were and they kept their debts down.

(2) Our agricultural colleges and federal and state agencies must provide better service and advice to the agricultural sector. Why did we not send out more serious warnings--more signals for change--to our farm and livestock producers? We are better at postmortems than early warning alerts. Ranchers, public-land managers, and conservationists should interact more closely with the scientific community to identify those problems for research which are critical to economic survival and resource conservation.

(3) Ranchers, public-land managers, and even research scientists are gradually losing the "tools" for manipulating vegetation. This is a result of state and federal regulations, and pressure from environmental groups and other special interests. I refer specifically to restrictions on brush and weed control, insecticides, predator control, certain range improvements, and livestock manipulation.

Recommendation: Since vegetation is the key to productivity and environmental stability, it is important that we continue to emphasize that the local managers must retain the flexibility and the opportunity to use all important and appropriate range-improvement tools and techniques to manipulate the vegetation complex toward both increased productivity and better conservation.

(4) Since the public pressures for multiple use of range resources will likely increase, we must search for ways to capitalize on these trends.

see news articles about ranchers turning over their land to recreation use as the cattle business weakens, about the market potential for mesquite as a fuel, and about using wildlife as an alternative source of income.

How many of these alternatives are available to the rancher? And, on public lands, why should the ranchers be the only users who pay to utilize the range resource? Who pays for the other uses of grazing land?

(5) Last, we need to design more sophisticated economic models that identify where management can make a difference. We also must move to the larger, more subtle and complex ecological, geosphere/biosphere studies of ecosystems. The earth is changing even as we seek to understand it--in ways that involve the interplay of land and sea, of oceans, air, and biosphere--and we cannot even presume that local change will be uniform in space and steady in time. Furthermore, we must use our skills and modern technology to construct interacting models--systems that show the interrelationships between ecology and economics. If we listen carefully to the echoes of these two ecos we should be able to design management systems that will properly balance conservation and economic objectives.

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THE ECONOMICS OF RANGE MANAGEMENT

By L. Tim Wallace[1]

The economics of the range management game today is survival. This means maintaining or increasing cash flow to the point where long-run profitability is more than a dream for the future. The question, How do we do this? It means taking advantage of every opportunity you can find as a manager, using all of your resources, and marketing them in the most imaginative way possible.

There are many factors beyond the control of an individual manager that affect the economics of his or her ranch. For example, the domestic deficit, interest rates, loan policies of lending institutions, the value of the dollar relative to other currencies, and trade policies of other nations. Let's acknowledge that these all exist, are real influences on our profitability in agriculture, and then go on to see what we might do with those factors that we can control.

This excellent conference program offers a veritable supermarket of items that can help. There are talks and exhibits on ways to improve one's physical resources: fertilizer programs, plant and animal breeding programs, different grass and browse varieties, and cultivation techniques and various herd management programs. Government tools are going to be discussed: tax policy, water management policy, and land use policy. There are discussions on how to take advantage of changing societal values that now okay recreation as an industry rather than condemn it.

But there are other items that are not here. For example, when Secretary Norton was discussing technology transfer at lunch today, how many of you thought about the technology of business management, marketing, merchandising, psychology, and political science? These disciplines offer a lot for ranchers and range managers. They complement the items listed in the program. Perhaps you might venture a look at what they can do for you.

The economic problem focuses on how to use fully all of one's controllable resources. I'd like to talk about some real life examples of different ways people have looked at their resource use problems, and set about erasing the problems by looking at things differently. Let's use the Law of Opposites as one of the powerful thinking tools that might help you get the most from what you control.

When Secretary Norton said we can't afford to hang onto nostalgia any more, I certainly agreed with him. Yet, the Law of Opposites says that while we can't afford to hang onto it in the range management business, perhaps we can't afford to not let others hang onto theirs. What we can do is capitalize on their nostalgia of the range, cattle, cowboys, and sunsets--while we become business people managing that feeling. Sound hard? It could make money for you. Let's take a look at how the Law of Opposites works.

When I first began ranching and logging, I was much influenced by a philosopher who long ago said that the questions remain the same while only the answers change. That makes increasing sense to me. Think of your own situation. The questions you had about your business and lifestyle had different answers even as short a time as 10 years ago. You do things differently now because of new technology, different family situations, different objectives, and different limitations in life.

My operation did not make me enough money to hire anyone when I first began it. Yet I needed some help to make it work and build for future profitability. How to get people? The opposite of paying people to work for you is to have them pay you to do the work. How can you do that? I did it by running an ad in an exclusive area of the eastern seaboard, lauding the western ranch life style, and wondering if there might be some adventurous young men who would like to sample ranch life for an appropriate fee. I got four extremely hard working, fine young people within a

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week. They paid me, and I gave them room and board and lots of hard work and responsibility around the ranch. They liked it, and I liked having them. The experience enriched all of our lives positively. I did that for three summers - through haying, working the cattle and sheep, building a corral, and rebuilding a barn.

I had to use some psychology, some marketing, some business sense to know what to charge them, and some merchandising to get my message out. It paid off. It means you have to be a little different manager than before, yet if you put enough into the experience everyone can benefit. It's a funny thing, too, that by capitalizing on someone else's nostalgia about the West I helped reinforce it in some ways.

Considering that the first marketing question is "What shall I produce?" rather than "How can I sell what I already have produced?" let's look at another example. Some of the more recent books on lifestyle and economics urge you to ask the question "What business am I in?" This isn't so easy to answer as it looks. When I worked with a group of cow-calf producers once, they answered that question by "I'm in the beef business." Yet about 2 hours later they admitted that the only beef they sold were cull cows and bulls, and that surely wasn't profitable by itself. The calves they sold went for feeders or stockers, and that's not beef yet. So they decided they were in the grass harvesting business.

Now let's return to the Law of Opposites just to stir your thinking a little bit about potential. A person can harvest grass through domestic animals (cows in this case) or through nondomestic animals. If you think of the range, immediately deer, elk, antelope, game birds, and so on come to mind as wild animals. And you also probably think of hunters as the natural form of a harvesting machine. Yet the opposite of hunters is nonhunters, and there are a lot more of them than there are hunters. Now maybe you could use both means of harvesting the range resource--which is the opposite of a single source of harvest.

Let's take a closer look at that nonhunter group. What do I mean? Well, what about bird watchers, photographers, people who just plain want to get out in the wilderness and breathe a sigh of relief? These people have money and would be willing to spend it for the properly cared for resource, if it were marketed well, and if the quality of the experience were high.

Let's take a further look. The people, hunters and nonhunters, are made up of fit people and not-so-physically-fit people. Marketing to the healthy community is one thing, yet marketing to the physically handicapped community is another, and it hooks you into one of the growth industries of today--health. Think of what it would mean to a person to catch a trout from his or her wheelchair, or for a person limited with a walker to actually feed a wild deer. Not only would it make them feel good, I have a hunch it would make you feel good, too. Sure, it would take a lot of planning, a lot of thinking and working out of situations you never dreamed of--yet all of that would be on top of being able to run your cow-calf operation still. There might even be some type of medical grant aid to help a person outfit a place with ramps and blacktopped pathways. Think of your place, its views, the game potential, the ability to watch your cows and feed your stock. It might just pay you to get into a couple of businesses instead of just one.

Another example of using the Law of Opposites was when a rancher with two sons decided he was land poor, yet he and his family really wanted to stay in the cattle business. What he did was say, "If I own the land and can't make much money, maybe I ought to sell it, yet keep it, and thereby make money." And that's what he did. He sold his land in blocks of 100 to 150 acres, with only one building site per lot. Each lot had a wonderful view and privacy. If the new owners wanted a horse or some stock, they had to put up a fence according to certain specifications set out in the deed that the rancher controlled. The end result was that the original rancher still had his cattle, still had access to all the range land, still had what profits his cattle could bring him--and also had about $5 million in bond investments drawing tax-free income. He controlled his resource by selling it with restrictions for himself and his family. He

arketed it to willing buyers of view homesites. le also gave his buyers the ability to become articipants in his cattle operation by forming a ooperative, permitting them certain tax writeoffs nd taking still less money out of his pocket. lis costs went down, his income went up. Not a ad way to stay in the cattle business if you can lo it.

a rancher who raised cows not to sell but to ent--to rodeo shows that needed roping animals nd stock for parades--used the Law of Opposites. nother individual went still further. He ollected cull cows from a group of ranchers 40 to 0 miles away from a railhead, buying them on redit. He advertised in exclusive business agazines that the reader had an opportunity to artake in an old-fashioned cattle drive, an Old lest experience. Customers came from the United tates and abroad, paying a very healthy fee. He reated them extremely well, complete with a fully tock chuckwagon, and provided a top-notch first lass experience. He gave them a half-day rientation in which they saddled up and rode round a corral, and soon he was pretty sure he new which ones could ride a horse and which ouldn't. He also brought along two or three real owboys and wranglers to see that the trail job ot done right. He obtained permits to cross BLM nd Forest Service land. He then made the drive nd sold the cattle. He collected on both ends nd made a considerable profit in between--and all y not owning any land or cattle himself.

nother perspective of the Law of Opposites says hat the nonfarm vote controls more farmers and anchers than does the farm vote. It can also be hown that the farm economy strongly influences he nonfarm economy. For example, a recent study in California shows that for that state alone leclines in the farm gate value of crops produced or export were about $1 billion in the period 1980 to 1984. This has meant a decline in economic activity of about $2.4 billion in the nonfarm economy, mainly in the food processing, transportation, food brokering, insurance, and packaging industries. The total of $3.4 billion has meant, as a worst-case scenario, a decline of about 100,000 full-time job equivalents in California alone. The same type of thing is also true in the Midwest, the South, and almost everywhere in this country.

We say we want to stay out of politics because it has no place in agriculture. Yet look at the control over resources the nonfarm vote has, and in some cases, how well intended and misguided it is. These are all opposites that affect us. Urban people who are well intended about conservation may not understand the full consequences of some of their actions. They may want to issue certain kinds of regulations about land use, wilderness preservation, and agricultural zoning that can actually encourage misuse of the land rather than encourage a healthy stewardship of our resources.

There are many who fear the continued or increased use of agricultural chemicals, and there are ways to reduce that dependency in some areas and perhaps not in others. We all have to learn that there is no free lunch, yet we also have to recognize that the answers to obtaining our agricultural abundance can change with scientific knowledge as well as with regulation. And that might mean increased funding for research and extension rather than reduced funding.

An example that might have more urgency in the West than anywhere else for agricultural people is in the case of urban concern about agricultural drainage water and possible ground water pollution. If onfarm ponding is sought as the solution, how many people understand fully that in a very short while the collected tail and tile water can result in a toxic waste disposal problem. And since society has still not altogether figured out what to do about toxic waste disposal, everyone has a problem. That is the kind of thing that the farm community ought to be courting the nonfarm community about--educating them, and helping them understand the resource consequences to ranches and farmers as a result of various policy alternatives. At the same time we agriculturists have to listen very hard to what the urban people have to say about their fears of real and imagined resource abuse.

This puts us right into trying to figure out what the role of government should be about our land

and water, our range, and our forests. How much freedom, how much regulation should there be? Will one type of farm bill handle all of agriculture, or will it cater only to the voting majority? It's clear that farmers and ranchers will have to think differently about political involvement or otherwise they will be reacting to decisions made by the nonfarm public rather than by a totally aware and informed combined farm/nonfarm public. It makes a difference for all of us about the place we live in.

As I talk with farmers and ranchers across the country, and we visit through the hail-fellow-well-met, I sense a bottom line fear of the unknown out there: What's going to happen? Let met tell you about one time I was scared silly. My wife and I were helping bring back a sailboat from Hong Kong to San Francisco. We came on deck to relieve the watch at midnight and the watch captain told me, "Tim, it'll be okay." I didn't know what that meant, nothing looked bad in the log, and the weather was fine although foggy. About an hour later, about 50 feet ahead a pool of light bubbled up from below. The phosphorescence was bright as if a huge light had been turned on in a 100-yard-diameter swimming pool. I sailed from a very stable dark water to a light water, and honestly felt as if I were going to fall right over the side of the earth. Dang it, all those guys who said the world was flat were right, and I'd just sailed right past the edge of the beyond. Well, light water is just as stable as dark water, but my heart was in my mouth. And agriculture is just about like that. Yes, it's scary now for a lot of us--and yet we are in a stable, here-forever industry. There will be some changes in the faces around us; some of us won't make it through. But most of us will. It won't be business as usual for those who are left. We'll have to think differently to survive. Yet most of us will do it. I have great faith and respect for people who make their livelihood from the soil and water around us. It'll be risky, but there's no profit without risk. So what's new in agriculture? We'll be okay in the end, just like that mate said.

WHAT SHOULD BE DONE TO CONSERVE THE RANGE RESOURCES TODAY?

By Ronald E. Sosebee[1]

Conservation was derived etymologically from the Latin words "com" and "servare," which means "to keep" or "guard." The concept was introduced into the United States by Gifford Pinchot (Chief, Forestry Division--now U.S. Forest Service) and Overton Price (an associate of Pinchot) in the early 1900's under Theodore Roosevelt's administration (Nash 1968). "Conservation" evolved to connote "wise use" of our resources while at the same time "husbanding" them for future generations (Nash 1968). Today, it is defined by Webster's Dictionary as "to keep in a safe or sound state." With the ever-increasing pressures to produce more red meat, supply more water, provide more recreation, and control erosion, it behooves those of us in the range management profession to closely examine our resources and determine ways to best conserve them.

Range resources of primary concern are vegetation (native and introduced), animals (domestic and wildlife), soil, and water. As we consider each of the resources, we must also consider the impact that mankind has had on the resources and, conversely, the impact that any change of the resource will have on mankind.

Vegetation

Native vegetation furnishes the forage base for most of the livestock in the western and southwestern United States and much of the forage base for livestock throughout the South, Southeast, and Midwest. Rangelands are perhaps in better condition than they have been since the turn of the century. Between 1935 and 1976, rangeland in excellent and good condition increased from 16 to 31 percent (Heady 1983). Currently, 34 percent of our rangelands are in good or higher condition and 50 percent are in fair condition. There still remains 16 percent of our rangeland in poor condition (Schuster 1984). Ranges in fair condition are providing a return at less than half of their biotic potential, while those in poor condition are producing at less than one-fourth of their potential (Schuster 1984).

Improvement and conservation of our nation's rangeland become more important every year. By 2030, the U.S. population will exceed 300 million; yet, it has been predicted that our rangelands will be reduced by 67 million acres, or 8 percent (Schuster 1984). There are several areas in which we should concentrate our efforts: grazing management, plant response to defoliation, efficient use of vegetation, revegetation needs and possibilities, native plant breeding, and control of noxious and poisonous plants.

Plant growth and development, response to defoliation, and grazing management are interrelated. However, all too often we have ignored the plant and devised grazing management schemes that sometimes benefit the grazing animal, or are convenient for the rancher. Convenience to the rancher should not be disdained, but the state of the range, vigor and reproductive capacity of the plants, and performance of the livestock and wildlife should not be ignored. Much of the time, we as professors, agency personnel, or consultants become "married" to a grazing system or management scheme and attempt to make all ranchers conform to our predetermined system or scheme. Regardless of the grazing management scheme employed, we should make a concerted effort to properly stock our range.

Every grazing allotment or ranch has its own peculiar conditions and situations. Every rancher or permittee has his or her own specific objectives. If we understood more about plant growth and development and how different plants respond to defoliation, grazing management schemes could be designed to benefit the rancher, increase the vigor of the plants, and improve the range condition. These schemes should be specific for each allotment or ranch.

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We need more basic and applied research into how key plants grow and how they respond to defoliation (time and degree of defoliation). Species, especially ecotypes, respond to grazing according to their evolutionary history; therefore, we need to know how they respond within each geographical region. As has been evidenced during the past few years in the central and southern Great Plains, we need additional information on how key species respond to various environmental conditions.

The point is often made that grazing should be eliminated, especially from public lands. Is this correct? Hughes (1983) reported that total protection from grazing did not always enhance range improvement nor improve range condition. Generally, rangeland vegetation in the United States has evolved under grazing pressure; therefore, eliminating grazing would be unnatural for the ecosystem and, ultimately, detrimental to the vegetation. This same argument can be made for specific grazing systems under various environmental regimes.

Agencies that have jurisdiction over federal lands or that advise ranchers and permittees should continually provide workshops and training sessions to keep their personnel abreast of new research and information concerning grazing management. It is extremely difficult, if not impossible, to send edicts concerning management schemes from Washington, or even state or district offices, to the personnel implementing the programs. Field personnel need to be appropriately trained, adequately informed, encouraged to think, and allowed to implement the scheme most suitable for the situation.

Another conservation need relative to grazing is efficiency in using rangeland vegetation. It is probably true that in the future we will depend more on the ruminant animal to convert low-value forage into high-quality human foods because of increasing costs of energy, fertilizer, etc. or decreasing quantity of water for irrigation (Heady 1983). Therefore, we should begin to plan toward this end.

It has been shown over and over that wildlife are usually more efficient forage converters than domestic livestock. However, a change from livestock production to wildlife, other than for sporting purposes, will require a major social change in the country. Regardless, there are areas where we as range professionals should consider production of wildlife rather than domestic livestock.

Realizing that most areas will continue to be grazed by domestic livestock, more information is needed to ascertain efficiency of breeds and kinds of livestock. We tend to raise the kinds and breeds of livestock that our fathers and grandfathers raised, or we select certain breeds for other personal reasons, usually without regard to foraging efficiency of the animal.

Our biases are not limited to kinds and breeds of animals, but also include marketing strategies and grazing behavior of livestock. Zimmerman (1980) aptly pointed out that ranching in semiarid areas presents some unique problems and opportunities. Cattle are usually considered primarily grazers, but many of the western rangelands are chiefly shrubs. Zimmerman does not wean his heifers. He leaves them with their mothers to learn how to browse shrubs, avoid poisonous plants such as halogeton and locoweed, locate water, and find protection from inclement winter weather. Undoubtedly, if Zimmerman's philosophy were adopted, range condition would improve and the vegetation resource would be conserved.

Artificial revegetation of rangeland in fair and poor condition is always difficult. Some questions related to revegetation are: Who will pay for the revegetation--and how? What species (ecotype) should be used--native or introduced? Will revegetation change the natural ecosystem?

Much to our surprise many communities as we know them today have not always existed. Vegetation changes in the arid Southwest have been documented by Buffington and Herbel (1965), Hennessy et al. (1983), Cox et al. (1984), and Herbel (1985). Concomitant with vegetation changes, carrying capacity has also decreased. Many communities today dominated by creosotebush were once

dominated by desert grasses. Production on many creosotebush ranges is as little as 50 lb/acre (and often as little as 5 lb/acre). Production on these rangelands can be increased to 900 lb/acre (C. H. Herbal, personal communication). Can we afford to not revegetate these areas?

There is no evidence that the Intermountain Region (or Great Basin) was dominated by anything other than sagebrush in recent geological history (Laycock 1979). Yet, under natural conditions, the carrying capacity is quite low (3 to 6 acres/animal-unit- month). Since we as range professionals are charged with conserving, or using wisely, our range resources, would we not be wise to reseed some of these rangelands to increase the carrying capacity?

The next question to ask is whether we should reseed with native or introduced species. Indigenous species are obviously adapted to the prevailing environmental regime and have evolved within the ecosystem. Because they are indigenous, once they become established, they will persist in the ecosystem. However, we usually attempt to revegetate with species that have low "r" selectivity (late successional plants; low sexual reproductive potential). Consequently, our revegetation success is low and those attempts that are successful usually require several years to acquire a desired level of seedling establishment.

In contrast, reseeding with an introduced species, whether it is crested wheatgrass, kleingrass, weeping lovegrass, Lehmann lovegrass, crabgrass, or some other species, will provide easier establishment and, very often, increased productivity. These exotic species may not persist as long as indigenous species, but during the period of increased productivity over native species, the time lapse between seeding and reseeding may offset the cost to reseed or rejuvenate the stands.

Certain problems such as disease and insects are associated with reseeding monocultures of exotic species. Therefore, we need to divert research dollars into breeding and selecting varieties or ecotypes of native species that are better adapted and more productive, water-use efficient, and insect resistant. We also need additional research concerning planting of shrubs and forbs, including legumes, in our rangeland communities. We have strived for years to identify and select those species that are highly palatable and nutritious to livestock. Perhaps we would run less risk of overgrazing or denudation if those species planted in semiarid regions were nutritious but not highly palatable, such as Lehmann and Boer lovegrass. With advances in biotechnology and genetic engineering, we should soon be able to design a plant to fit whatever conservation needs we have, and produce it.

The last point to consider relative to vegetation concerns encroachment and invasion of noxious and poisonous plants onto productive rangeland. Poisonous plants cause serious economic losses annually (Lynn James, personal communication). Often these losses extend beyond deaths of livestock and include weak and light calves that remain sickly throughout their life and never gain weight as they should (Lynn James, personal communication). Noxious plants, other than those that are poisonous, drastically reduce the carrying capacity of rangelands. Broom snakeweed infestation, a serious problem throughout the Southwest and a localized problem throughout the western United States from Mexico to Canada and from the Great Plains to the Pacific Ocean, can easily reduce the carrying capacity 3- to 4-fold. Invasion of creosotebush in the Southwest and occurrence of sagebrush in the intermountain area significantly lower the carrying capacities of their respective regions. Many other examples could be cited, including leafy spurge and knapp weed.

Can we afford to not control these areas and return them to a more desirable productive state? The cost of control often seems prohibitive, but the ranchers and landowners have only four options: 1) go out of business, 2) buy more land, 3) lease land, or 4) control the noxious or poisonous plants. Control measures are usually cheaper than buying additional land; and, land is often not available for lease. Therefore, the ranchers' options are reduced to going out of

business or controlling the noxious or poisonous plants.

The statement is often made that "we should only expend money to control the best (or better) sites." The statement is correct, except we have misidentified or failed to recognize the better (or potentially more productive) sites. In the Southwest, we have concentrated our control on mesquite when the increase in herbaceous production following control averages only about 20 percent. Would we not be wiser to control such species as snakeweed or creosotebush (C. H. Herbel, personal communication) on sites where production can be increase tenfold, or greater?

Although our rangelands are in better condition and more productive than they have been in many years, perhaps since the Civil War, there is much that can be done to increase their productivity.

Animals

Animals (both domestic and wild) are an integral component of our operations. Much has been written about the herbivory efficiency of both wildlife and domestic livestock. There is little question that wildlife more efficiently convert low-value forage into protein. However, for many reasons we are not going to have wholesale conversion of management systems from domestic livestock to wildlife.

Conservation of rangelands under certain conditions and circumstances might dictate that we seriously consider replacing our livestock with wildlife. The number of ranchers offering an integrated wildlife-livestock operation is increasing, especially as livestock prices decrease and the profit margin in ranching narrows. Leasing arrangements for hunting big game animals and upland game birds especially lend themselves to a ranch operation. Certainly, where appropriate habitats exist, we should consider the complementary effect of both wildlife and livestock.

Additional information is needed on diets and food habits of both livestock and wildlife when they share a common range resource. We need better methods to count wildlife populations (S. Beasom, personal communication) and to calculate carrying capacities involving common range use by wildlife and livestock. Current methods of accurately estimating wildlife populations are expensive and time consuming.

Recognizing that we will not soon divert our western rangelands from primarily livestock to wildlife use, we should ask if the kinds of livestock being grazed are best suited to the range resource they are using. Are sheep or cattle best adapted to the range they are using, or are we cattlemen or sheep ranchers because of tradition? Could goats better utilize the dominant vegetation, or would the vegetation benefit from a combination of cattle, sheep, and goats? Many factors influence ranching practices besides the vegetation resource: predators, markets, and infrastructure are but a few. Where possible, however, we should consider the different kinds of livestock. Goats could even be used as a means of biological control of some of our noxious plants.

Another question that needs to be addressed involves breed of livestock best adapted to our particular rangeland. It seems that our range resources could be better conserved if we selected those breeds (or crossbreeds) best suited to the aridity, flooding, terrain, temperature, insects, internal parasites, principal forage or browse species, etc. rather than the breeds we have raised because of tradition. Size of breeding animals should also be considered. Are maintenance requirements (forage) greater per pound of calf weaned for some of the exotic breeds than for some of the Indian or European breeds?

A major concern that directly affects conservation of our range resources is the number of livestock operators who have small acreages. These individuals either have other employment and don't depend upon the farm for their living, or they are trying to eke out an existence by "milking" the land for all it is worth. Both groups usually must have more animals than the land can carry to provide the necessary economic base for their livelihood; thus, they damage the resources. We need to assist these landowners and operators in

mplementing conservation practices that enhance heir operation and protect their range resources.

would be remiss if I did not include the roblems caused by wild horses and burros. There eems to be no other class of livestock that can e as destructive to the vegetation resource as orses. It seems almost criminal that we must perate within such rigid restrictions in controlling these feral populations when valuable esources of soil, water, and vegetation are at take. The horse craze in America today is causing similar problems on private lands that the eral horses cause on public lands.

The livestock industry is suffering today from negative publicity regarding nutritional quality and healthiness of red meat. The short-term effect on rangelands of this publicity might be positive because of the reduction of livestock numbers. The long-term effect, however, might be adverse because of the number of family ranches that will be dissolved and taken over by large corporations who have no real appreciation for any of the range resources--only the bottom line profit.

Uses of rangeland resources that have been only slightly addressed include those by small mammals, invertebrates, rabbits, and burrowing animals (Pieper 1981). These animals potentially can destroy more vegetation and disturb more soil annually than domestic livestock or wild ungulates. Placing these animals in their proper perspective within the ecosystem could significantly increase availability of other rangeland resources.

Soil and Water

The wealth of any country is its soil and water resource. With all that has been written concerning desertification, the United States is poised for a dust bowl worse than the one that occurred during the 1930's (H. Dregne, personal communication).

Water is a precious commodity that we take for granted, until we experience serious water shortages. We continue to "mine" our aquifers as if they contain an unlimited supply of water. According to statistics compiled in 1985 by the National Geographic Society, major population increases are expected in the western United States. At some point, there will not be sufficient water to support growth of populations in these arid and semiarid regions.

Dr. G. W. Thomas (1981) reported that 100 metric tons of water are required to produce 1 kg of beef on part of the western rangelands. Much of the 100 metric tons are evaporated from the soil surface or are transpired from undesirable woody or herbaceous plants. It is not uncommon for undesirable annual forbs to reduce grass production at least threefold in the Southwest.

Most adapted noxious woody plants are opportunistic. They consume great quantities of water when the supply is plentiful, yet they survive quite well when the supply is limited. A serious problem that needs to be addressed immediately is the occurrence of salt cedar along the major waterways in the Southwest, and its continual movement toward the Gulf of Mexico and the Pacific Ocean. It consumes tremendous quantities of water and depletes water supplies that otherwise would be available to downstream consumers.

It is unfortunate that species such as salt cedar were introduced for shelterbelts or landscaping. More research needs to be conducted on the water use of a species before it is introduced for our "protection" or as an ornamental.

Control of noxious plants will not always guarantee increased water yield. Since these plants are opportunistic water consumers, control should be directed toward those strategic areas where water is more abundant. Controlling mesquite on shallow soils, upland sites, and in sparse stands will not significantly increase water yield. However, control on deep soils, along streams and rivers, and in areas where the water table is shallow will significantly increase water yield. Similar results have been reported for sagebrush in the Great Basin (Sturgess 1980).

Undesirable forbs can easily reduce production of desirable herbaceous vegetation 3- to 4-fold. They exert their influence during the winter and spring before warm season vegetation begins growth. By the time spring growth of warm season plants should begin, soil water is limiting because it has been depleted by the undesirable forbs. Can we afford to not address this problem?

A greater effort should be made to retain precipitation onsite. Retention terraces in valleys, bolsons, and other areas subject to run-on water significantly increase herbaceous plant production and, if managed properly, will increase carrying capacities of many western ranges. For years the U.S. Department of Agriculture's Agricultural Research Service has studied snow entrapment and construction of snow drifts that will most effectively increase water yield. Yet, this practice does not seem to be utilized to a very large extent. Large quantities of water are not being harvested from intermountain and northern Great Plains rangelands by drifting snow. In areas where the snow is trapped, soil water is significantly increased. Where snow drifts are constructed by design, they accumulate more snow and melt slowly so water can be released throughout the summer and reduce the problem of flooding and soil erosion.

Soil erosion by water continues to plague us, even though soil conservation is one of the oldest conservation practices in the United States. Admittedly, most soil that is lost via water erosion occurs on cropland, yet soil continues to be eroded from rangelands. A factor that we fail to realize is the intensity of rainstorms in the Southwest. Since most of our spring and summer rains occur as the result of convectional storms, the intensity is usually high. It is not uncommon for the initial 10 to 15 minutes of a thunderstorm to have an intensity of 5 to 10 inches per hour. Without question, splash erosion is extremely high and compaction of the surface by raindrop impact is great. Runoff is excessive during this period. After the initial 10 to 15 minutes of the storm, the rate of rainfall is often immaterial because the bare soil surface has been compacted and puddled and much of the rainfall runs off and is rendered unavailable to the vegetation. It is imperative that a vegetative or litter cover protect the soil. Also, higher rates of infiltration are nearly always associated with higher amounts of organic carbon (organic matter) in the surface soil. Rangelands in fair or poor condition afford very little, if any, protection to the soil surface.

Deteriorating rangeland not only enhances water erosion, but also opens plant communities and exposes them to wind erosion. Chemical control of mesquite in southern New Mexico allowed an increase of herbaceous plants and deterioration of the dunes. It also reduced the amount of soil blowing by 15-fold beyond 180 m into the sprayed area (Gould 1982). Can we afford to not control noxious woody plants on deteriorated rangeland and marginal sites?

I wish to reiterate part of Dr. Schuster's (1984) testimony to the Republican National Committee on Agriculture in 1984:

> "It [soil and water resources] is the strength of our nation and its conservation is the responsibility of the landowner (public or private). We as a nation must realize that there is a cost for the conservation. The public must realize that the operator is not the only beneficiary of rangeland conservation practices. The enhanced environmental quality resulting from conservation is generally an offsite public benefit. Therefore, as a nation, we must be willing to help the land user apply long-term conservation treatments. The Administration should consider tax incentives for conservation practices: long-term, low-interest loans for conservation treatments; and direct cash outgo in USDA programs toward range conservation. The USDA must adopt policies that will provide economic incentives rather than economic penalties to range conservation efforts by private operators."

I'll add to his testimony that states and urban areas should also expect to partially defray the cost of certain conservation practices that will directly affect them, such as by increasing water yield.

Recreation

Recreation is not a resource, but a pastime that uses or provide enjoyment of the range resources. Many urbanites seek opportunities to get out of the city and take advantage of the space and resources provided by most rangelands. Many of these people have little regard for either private or public property. Leasing hunting privileges either to individuals, groups, or sporting clubs not only serves as a source of revenue, but also reduces poaching, damage to property, and injury to livestock (Reininger 1979).

Paid hunting and fishing leases usually provide greater conservation of rangeland resources than free hunting and fishing. It has been suggested (J. W. Thomas, personal communication) that the federal agencies should sell hunting rights, stamps, etc. This would provide additional revenue to offset costs associated with management of wildlife, provide for wiser use of the resources, and provide hunters a stronger voice in the land management decisions for public land.

As urban populations grow and the ranching economy falters, more innovative recreational concepts will be put into practice. Someone in the federal agencies should be charged with regulatory control to ensure that our public resources are used properly and not abused.

Socio-Economic Impacts

Implications of socio-economic impacts have been made throughout this presentation. Care needs to be included in planning conservation practices so that no user of rangeland resources will suffer. Also, action needs to be taken soon so all people can benefit from conservation before it is too late to salvage our rangeland resources.

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NFLICTS IN THE USE OF RANGE--CAN THEY BE SOLVED?

Dayton O. Hyde[1]

our ranges we face either the best of times or e worst of times, depending upon where we go om here. For various reasons the system we now ve is not working. We have encouraged public rticipation in land use issues but not lightened public participation. Emotional volvement is good as long as it is accompanied facts and common sense.

we think of our natural resources as an orange, ere are many user groups competing for a slice that orange. When one group is able to muster ough political force to gain a larger slice, it llows that the other slices have to get smaller.

creationists think of our ranges in terms of creation and wildlife; agriculture sees a source forage for livestock. The fishermen see our vers as fishing; industrialists see them as urces of power, and means of transportation of w materials in and finished products out. City nagers see streams as handy ways to remove stes; white water rafters see them as a source quality recreation. To the farmer and rancher ey are the life blood of agriculture. We select om the pool of facts to build a case for our own rticular interest, and become hard nosed in our aims. Seeking funding or political support for r causes, we deliberately mislead the public, emingly unaware that this force may continue its volvement and one day become the tail that wags e dog, or the seed that becomes a weed in our rden.

ifts in the balance of political power have made e multiple-use concept an abused child of the stem. Public agencies have been just as guilty organizations in disorientation of the public wildlife and land use issues. I know of few other issues that can illustrate my point better than the highly charged issue of grazing of privately owned livestock on public lands. The public has been led to think that the opposite of grazing is nongrazing and that if such a condition were achieved the land would benefit.

There are certain realities the public has not been taught: the devastating effects of a buildup of combustible vegetation, loss of vegetative diversity including wild flowers and forbs when grazing is excluded, and the long-range down turn in health and palatability of beneficial plant species. Another is the hastened eutrophication of wetlands by coarse vegetation when production is left to rot.

Public agencies have created a myth that they are the sina qua non of wildlife existence when actually most public land areas are not independent systems, but rely heavily on adjoining private lands. Sixty percent of our forests in the continental United States are private. Eighty percent or more of our wildlife is dependent not upon public lands but upon private lands for habitat. With increasing land use pressures, it will not be long before the only privacy left our wildlife will be on private lands.

In range areas especially you find small privately owned areas furnishing water, food, shelter, and privacy that make thousands of acres of adjoining public land viable for wildlife.

And yet, recently, when newspapers such as the Wall Street Journal were full of letters to the editors from critics of grazing policies, the agencies were curiously silent. No one pointed out to the public the rest of the story, that we are heavily indebted to those ranchers who graze public lands for their great contributions to the public's wildlife, that without private lands much of our finest wildlife habitat would be lost.

At a time when agriculture is facing financial disaster, no one has pointed out that when the small farm or ranch family is forced off the land and corporate agriculture without conservation or wildlife conscience takes over, then wildlife is one of the main losers. Wildlife has an immense

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Rancher, conservationist, and founder and esident of Operation Stronghold, Chiloquin, egon.

stake in the well-being of American agriculture. Of all the states, my own state of Oregon leads the way in land use socialism, and this philosophy has tragically backfired for wildlife. State agencies have failed to educate the public as to the great contribution made to wildlife by private lands.

The landowner who builds wetlands or other forms of wildlife habitat upon his private land, or otherwise encourages the presence of wildlife or a viable fishery, suddenly finds that the state has moved in to zone his lands and restrict his management options, thereby drastically decreasing his equity in his land without just compensation. Those landowners who would be willing to sell conservation easements to the public suddenly find that the state legislature has taken those rights and left them with nothing to sell.

Public agencies have become adversaries of the landowner. When land is taken by Right Of Eminent Domain as a roost for eagles, the rest of the landowners look to their own eagle populations and wonder how smart it is to keep them. When wildlife commissions earmark private lands as important to wintering elk and move in to restrict the landowners by zoning, other landowners look to their own wildlife populations and have doubts.

On my own private land in Oregon, I put 25 percent of my land back into marshes and initiated research on crane behaviour, which has helped bring the whooping crane back from near extinction. I also built a lake with 3-1/2 miles of shoreline just for wildlife. This body of impounded snow water now makes thousands of arid acres of adjoining national forest viable for wildlife, where, formerly, in July there wasn't water enough for a chickadee to drink.

Eagles and ospreys have moved in to feast on trout weighing up to 14 pounds. Thousands of ducks, geese, and swans rest there in migration; hundreds breed there in the summer. This past summer, within 100 yards of my cabin, 43 species of birds nested where only 4 species nested before. I have done my riparian work along my river and built a trout fishery as well as a wildlife spectacular which biologists tell me far exceeds public land in quality.

Seven years ago, I purchased a run-down ranch in the John Day valley and turned it into a wildlife haven, restoring its public and private ranges alike to productivity. I wanted another showcase where I could show the public just how vital and exciting properly managed private land could be wildlife. The place has exceeded my wildest expectations.

But now? You're right. My land has been zoned. I am being regulated for wetlands that weren't there before I created them. Like most of my neighbors I can save myself from financial disaster only by some creative land management, but the legislature has cut out most of my optio

This is not just an Oregon problem. About 4 yea ago, excited by the response of wildlife to my private land habitat management, I started a non profit foundation called OPERATION STRONGHOLD, dedicated to the creation of wildlife habitat on private lands. We now have over 3 million acres of land dedicated to programs of significant val to wildlife.

The members are ranchers, farmers, and forest owners who, like me, enjoy personal involvement with wildlife by creating habitat. Our projects are as varied as our lands; we do everything fro restoring native prairies to planting for butter flies, building nestboxes for sparrowhawks, creating wetlands, riparian restoration, you nam it. Instead of "No trespassing," our signs say "Private land wildlife stronghold. This landown cares. He has dedicated this property to a wild life and conservation program of significant value. Wildlife need privacy. Do not enter without written, dated permission."

We are dedicated to proving to the public that private land is special and serves a function public land simply cannot serve. We don't wish compete with the public resource but rather to enhance it by our contributions of habitat, and set a standard for public land managers to shoot at. We have forged a few private grants and our membership dues into a good common sense,

actical program for wildlife that has helped
ldlife in several countries and has yet to cost
e public a penny.

t more and more as I address private landowners
ound the country, I hear doubts. Often now
ndowners tell me, "Look, you don't understand.
would like to do our share for wildlife but we
e afraid if we create something worthwhile, the
blic will take it. It's just plain easier to
erilize the land."

ere are some public land managers who see other
encies and the private landowner as competition
r the wildlife management dollar. But if those
o use our land resource want a larger slice of
e orange, we had best make the orange larger.
can do this by developing a better working
lationship between the agencies and private
ndowners, and provide both with incentives.

face exciting times for wildlife if agencies
sponsible for resource management will initiate
coordinated venture with the private sector in
eation and maintenance of the wildlife habitat,
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nding of reasonable incentives so that the
ivate landowner can consider raising wildlife
bitat an alternative to standard crops without
ar that the public will take his rights without
st compensation.

RESEARCH AND TECHNOLOGY--WHAT ARE THEIR IMPLICATIONS FOR RANGE MANAGEMENT IN THE FUTURE?

By Alvin L. Young[1]

I was a young man of 17 when I accepted the job of summer field assistant for the Plant Science Division, University of Wyoming. The invitation for such a job came from a faculty member of the Range Management Section, a man who as a scoutmaster had had profound influence on many young men in Laramie. It was June 1st when Dr. Alan A. Beetle, known as "Doc" Beetle to all of us, came to my house and told my mother, "Mrs. Young, if you'll just see that he's got his working clothes and his toothbrush, we'll be on our way. I'll make sure he drops you a note, but we won't be back until August 21st." So began a great experience in my life, an introduction to science that I would never forget and the opportunity to see the wonderful lands of my state from the perspectives of a truly great range manager and range scientist. For five consecutive summers, Doc Beetle taught me the impact of geology, hydrology, and climate on the ecology of the ranges of Wyoming. He taught me the balance between wildlife and cattle and how to use the "square foot" to judge the pressures on the land from both. But perhaps best of all, he taught me respect for the land and that I, too, had a responsibility for its future. Then, as now, I realize that the future can be greatly influenced by the amount and quality of science we devote to understanding range ecosystems. Thus, today it gives me great pleasure to share with you my version of how science and technology can impact the future of range science, and what we must do to enhance research opportunities.

During this past year and a half, in meeting my responsibility as the agricultural research advisor to Dr. Jay Keyworth, the President's science advisor, I have visited many of our land-grant institutions and our federal agricultural laboratories. Doom and gloom has not been what I have seen. Indeed, what I have seen is the intense interest and enthusiasm of young men and women learning to use the tools of biotechnology. Agricultural science is on the verge of a new step in harnessing and using our knowledge for the betterment of mankind. The methods and products of biotechnology will change the face of our lands and the very fibers of our society. However, the transition that the scientific community must undergo will take more than ability and hard work. It will take heavy financial commitment and a proper environment to encourage innovation, competitiveness, and vision. This means a recommitment of federal and state funding for research. This is especially true for the situation now facing range science. Two decades of minimal federal, state, and industrial support for range science has left this nation an infrastructure inadequately prepared to capitalize on the recent advances made in modern biology. The fact is that minimal federal support for research has contributed to:

- An economic plight of agricultural enterprises dependent upon rangelands.
- Environmental concerns arising from real and perceived perturbations to rangelands.
- A decline in size and quality of our professional scientific cadre.
- A decline in student enrollment.

As with other areas of agricultural research, we are, as the economist would say, spending the principal at a faster pace than the interest is accruing:

- The scientific foundations for future and applied research and management decisions ar not being adequately replaced.
- We are confronting rangelands that have decreased productivity; decreased utilizatio efficiency; deteriorating soil, water, and wildlife conditions; and drastically limited opportunities for recreation and esthetic experiences. Our rangelands are renewable

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natural resources that contribute to our quality of life. We must not, and cannot, ignore them.

- We are seeing a "graying" of our scientific personnel and a decrease in the opportunities that are needed to attract new recruits.

ew knowledge has to be discovered. New echnologies need to be developed and perfected. ew generations of scientists, engineers, echnicians, and managers have to be educated. or decades now, the Nation's research and ducational establishments have been pressured to reate a constantly increasing base of scientific nowledge, technological innovations, and ell-qualified manpower. Pressures have been trong and successes have been notable. But the ellspring of fundamental knowledge from which new anagement systems must be derived is no longer dequate to ensure continuing success. If the uality of natural resource management is to ontinue to improve, the present state of theory nd understanding of complex systems must be dvanced.

hat, then, must be our goal for range research? n answer lies in a report prepared in December 984 by the Research Affairs Committee of the ociety for Range Management. According to that eport, entitled "Rangeland Research: An ssessment of Future Needs and Proposed Research riorities," "the range research goal should be to nderstand the biological and physical mechanisms f range ecosystems well enough to predict with easonable confidence the results of alternative esource uses."

ow do we accomplish this goal? We must pursue uch critical research areas as--

- Basic Plant Biology - Understanding the genetic and physiological aspects of plant growth is essential if we are to know the critical limits to rangeland productivity.

- Ecological Processes - Scientific management requires a detailed understanding of the dynamic changes in rangeland ecosystems as the vegetation regenerates, matures, and eventually declines in productivity. Such information is needed to established guidelines for ecologically sound management under a wide range of environmental conditions.

- Soil Processes - Much of the productivity of our range ecosystems comes from recycling nutrients in organic materials on the site and from symbiotic and nonsymbiotic nitrogen fixation. These processes are mediated through a myriad of soil microorganisms.

- Biotechnology - Plant resources are being studied at the organism and community level but, except for a few forage plants, they are essentially unknown at the genetic and molecular level. To effectively use the tools of biotechnology, we will need to better understand the genetic makeup of our range plants.

- Commodity Conversion - We must develop new uses for range products and new methods for enhancing their value. I'm reminded of the successful efforts to convert beef tallow to a high-grade oil that is now used in the production of chocolates. In addition, I'm aware of the efforts to produce a number of economically and strategically important products on rangeland, e.g., guayule for the production of natural rubber.

Given that we as range scientists have identified our future needs and research priorities, what are the available resources and how do we implement the programs? Each of the research agencies within the U.S. Department of Agriculture (USDA) has programs devoted to range science. Moreover, the National Science Foundation (NSF) and the Department of Energy each has programs devoted to plant science on which we can piggy-back some range research.

What are the magnitude of dollars that we are talking about? Specifically ear-marked for range research are about $12.4 million federal dollars combined from the Agricultural Research Service, the Forest Service, and the Cooperative States Research Service. In addition, about $2.5 million

are provided for the Renewable Resources Extension Program. The states (mostly western) provide through the Agricultural Experiment Station System about $13.1 million. Thus, as a nation, we are providing only $27 million for research support on lands that comprise more than 850 million acres in the United States.

Before commenting in this sorry state of funding, let us examine the situation for the plant sciences in the United States:

- Undergraduate enrollment in agriculture at land grant universities has declined 30 percent in the last 10 years. This diminishes the pool of American students available for

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  awarded in
  in this field.

- Funding from all sources for plant biology in U.S. universities in 1983 was $202 million. The federal government's share was $98 million. Of the total federal investment in universities for basic research in biological and medical science, plant biology received only 2.6 percent of the funds.

- Only $25 million was awarded for plant sciences by USDA's competitive grants program in FY 1985. These dollars funded 284 awards, or 23 percent of the proposals submitted. Review panels concluded that almost twice as many proposals could have been funded based on their quality. (The annual rate of USDA's growth in funding of agricultural research between 1967 and 1983 was 0.5 percent in constant 1967 dollars).

- The estimated investment in plant science by NSF in FY 1985 was $56 million divided between environmental biology (42 percent) and molecular/cellular biology (58 percent). The overall competitive success rate was only 32 percent due to shortage of funds rather than quality of proposals. NSF's average annual award was $50,000 including indirect costs--less than one-half the average award by the National Institutes of Health (NIH).

- The Department of Energy's Division of Biological Energy Research, Office of Basic Energy Science, funded about $9 million in plant science in FY 1985. The average annual award was $77,000 including indirect costs, but applicants "enjoy" a competitive success rate of 17 percent due chiefly to the shortage of funds.

- Forty-one percent of major doctorate-granting institutions that have graduate programs in plant biology are understaffed in faculty. Molecular biology is the most frequently cited area of shortage of tenure-track faculty positions, doctoral research associate positions, and postdoc training positions.

What conclusions can be drawn from these facts? Plant science is critical to our plant production industry but its knowledge base is not growing fast enough to sustain U.S. economic supremacy for the 21st century. Advances made in the molecular and cellular biology of microbes and animal cells, chiefly from NIH-sponsored research, catalyzed a health-related biotechnology industry. The knowledge and methods are at least partly applicable immediately to plants. Strong in-house industrial funding to take advantage of this technology transfer is evident. but the previous 20 years of paltry support for basic research in plant science has left academe unable to be a truly effective industrial partner, and worse, unable to capitalize on its traditional role as the principal trainer and supplier of talent and contributor of intellectual excitement. The plant sciences are clearly underfunded by at least 50 percent. Instead of $200 million, at least $400-500 million need to be annually committed.

The Office of Science and Technology Policy (OSTP) in concert with the USDA's Assistant Secretary for Science and Education is aware of this crisis in funding of plant sciences and range sciences. Accordingly, the President's science advisor and the Secretary of Agriculture have endorsed the funding of a major initiative in plant sciences research for agriculture.

lthough this effort will not be officially nnounced until mid-November, this research will e part of an overall science initiative advocated y OSTP. Funds in the amount of $50.1 million are roposed for FY 1987 and for 4 additional consecuive years. This would enable the equivalent of 65 science years of new research per year in nine ritical areas including range science.

s now planned, the initiative will be principally niversity based and will establish a series of ocused centers of research. It will involve ooperation with related federal and industrial ounterparts. In some cases, networks of scienists will be created to work on common problems ithout physical co-location--effectively, a enter without walls. The initiative will build n strengths of the land-grant university system or research, whose infrastructure ensures most apid transfer of technology. This effort is a tart! When these federal dollars are leveraged y state and private dollars, a significant impact ill occur.

am excited about the future of range science. ew opportunities for research are vital to the ontinued health and growth of this multiiscipline field. Funding for range science is ssential if we are to meet the needs of modern ociety. With your assistance, we will be repared to meet those needs.

ECONOMICS OF RANGE MANAGEMENT TODAY

MODERATOR'S REMARKS

By John Fedkiw[1]

This panel on Economics of Range Management Today brings together Dr. Gerald Thomas' "ecos" of ecology and economics. Here also is where the research technology and the conservation practices get put together with ecology and economics. Likewise, it is in the range management decision that the resource-use conflicts and multiple uses are finally decided on the land.

These decisions need to meet the test of the marketplace. And as you heard at the conference overview, these decisions must provide a profit, ensure long-term productivity and conservation, and meet the needs of environmental and other user interests, including wildlife.

Our panel will also discuss institutional factors affecting range management decisions, particularly tax policy and state programs. There are other institutional factors influencing range management but there is not time to address them here. They include pesticide regulations, constraints on use of habitat for endangered and threatened species, predator-control regulations, environmental laws, and so forth.

Our panel does not provide specific answers. But they will bring much enlightenment from their long and rich experience. The answers lie with each of you as you exercise your responsibility as professional advisors and managers as well as citizens. That responsibility relates to the individual decisions that you influence or make for particular rangeland management units, in planning and managing public programs, and in voting for public legislation relating to rangeland development.

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RANGE MANAGEMENT AND EFFICIENT RANGE OPERATIONS IN TODAY'S TOUGH BUSINESS CLIMATE

By William J. Waldrip[1]

Ranching in today's business climate is tough. But, if a person has his land paid for or his lease is reasonable, and he hasn't got too big a debt load to service, he ought to be able to make it even in today's business climate if he manages fairly well.

In our country it is not just the debt load that has made things tough. For the last 3 years the business climate hasn't been nearly as tough as the climate "climate." There is nothing in ranching that can be compared with the nightmares brought on by nature's drought. For many of us the weather got worse as the economic conditions got worse.

But dry weather is fairly common in all the Southwest and greater parts of the rangelands of the West. That is the reason it is rangeland. So, we might as well build a cushion ahead of time in order to get through these hardships.

I think that we range producers are way ahead of everybody else in our opportunity to survive and make a profit in the livestock business. But there are some things that we had better do if we are going to survive and profit. We have to be flexible. We have to have a management system. And we have to be innovative as well as knowledgeable in marketing, breeding, and nutrition.

Flexibility is a big factor. We had better be flexible in decisionmaking and in livestock numbers. No piece of rangeland has a fixed carrying capacity. A 200-cow outfit might range from 0 to 300 head in carrying capacity over a period of years, and there might be only 1 day of the year that 200 is the correct number. On my operation we try to stay flexible by keeping other animals in addition to the breeding herd. We keep stocker calves, and we keep more replacement heifers. In good years we'll keep the late calving cows and their calves that we would normally cull.

We should have some system or method of utilizing our rangeland. No longer can we get by with turning our animals loose and clipping the coupons once a year. We need a grazing system or method that takes into account the needs of the vegetation, the growth habits of the forage. We should make sure we get full use of our forage, but it should be full proper use and we should understand the limitations of the resource that we are working with. Asking the range to provide more than it is capable of is the quickest way to get introuble. If drought comes when we push our country a little more than we probably should have, we are going to suffer a whole lot more and a whole lot quicker than if we hadn't been so greedy.

We know that few, if any, practices are as destructive as overuse, and I mean economically destructive. We cannot stay in business if we misuse our land. I really think, though, that we have reached a point in the United States where overuse is not a common practice. I think that most of our overuse today occurs where the range makes up only a small portion of the enterprise.

If we manage our country pretty well when droughts come along, we can get through them without any ill effects and can last into them much longer and come back much quicker. But there are two or three things that we need to keep in mind when encountering droughts. First, we cannot feed through them. Generally, we shouldn't even try. It is a terrible mistake that we make. We say, "Well, it may rain next month, so we'll try to hold on until then." We cannot see through a drought. With few exceptions we cannot run from drought either. We should start making our moves well ahead of the time when we are forced to make them. And we need to set priorities for those moves. A year ahead, we need to know what we are going to do at each step as we get deeper and deeper into this period that makes management so difficult. We need to let the forage dictate our decisions. If livestock condition is our key, we have already waited too long.

1/ General manager, Spade Ranches, Lubbock, Texas.

Even if we go 20 years without an abnormal drought, we can still get in trouble on native range if we keep doing the things that our grandfathers did--and our fathers did and many of us still do. We have got to be a little bit more innovative in our business than we have been. We have got to be more knowledgeable in things other than animal husbandry and range management. We have got to know a little bit about marketing, and we have got to be innovative in our marketing, breeding, and nutrition. About that innovation, let me just make the following few points to stimulate discussion:

- In marketing, calving in spring and selling in fall is the best way I know to go out of business.

- In breeding, from a commercial standpoint the cross of any two breeds is generally better than either parent. And personally, I don't think two parents are enough.

- Nutrition in ranch country generally means supplemental feeding. I think we should make sure that our feed is supplemental. We are not depending on feed that we haul to the animals to make up the basis of the ration that we use in rangeland to support those animals. We probably waste more money on supplemental feeding and minerals than on any other output.

To be the most successful manager, we must have some understanding of the whole picture, the entire spectrum of factors that affect the business. It is not enough to be a good range scientist or good animal scientist or agronomist or nutritionist or so forth. We have to be businessmen in the cattle business, and we cannot be cattlemen if we market our animals once a year. There is a difference. And I think that if we don't understand the entire spectrum we could get into trouble.

I don't think we will have a great deal of relief from these unfavorable economic conditions anytime soon. But, I think the ranch livestock industry will continue to be an important contributor to our food supply. There are a couple of good reasons. In the first place, it is easier to economically produce red meat from rangeland than from any other source. And in spite of all the debate about other uses, the most important use of rangeland is going to continue to be ruminant grazing because the land is not fit for much else. Another important point is that production costs in our business become more competitive as grain prices rise. Range livestock production requires little grain; and even finished beef requires grain for only the last 20 to 25 percent of the total weight. Our competition requires 100-percent grain rations not only in the finished stage but also in the breeding herds and flocks. so, actually, we are going to be fairly competitive with other meat industries even though their animals are more efficient converters of grain than the beef animal. Not a chicken in the world can turn the cellulose out in the pasture into high quality protein. And that is where our advantage lies.

This is an appropriate time to discuss tax policy as it relates to agriculture. The Congress and the President are attempting the first complete overhaul of the tax system since 1954. Their attempt has certainly been slowed by a substantial lack of interest among most voters, but they are apparently serious about some kind of tax reform by the end of the 99th Congress in 1986.

Let me start by saying that an effective tax code is one that does not detract from the economic decisions that a businessman makes. In other words, good tax policy does not encourage bad economic decisions, nor does it discourage good economic decisions. There are features of the present tax code that fail these tests; by the same token, some of the proposed reforms also fail the tests.

Range management practices generally are--and should be--independent of the tax code. With few exceptions, range practices will be adopted or abandoned because of the economic merits of the practice, not the tax consequences. Where the exceptions occur (e.g., on breaking of rangeland for crop production), tax reform will likely eliminate the tax incentive.

As I address this topic of tax policy and range management, I will mention how possible changes considered by Congress will affect agriculture, and particularly livestock. But first let me comment on a troubling perception about the effect of the present tax code on agriculture.

The effect of the tax code on agriculture is a subject of considerable debate at present. There is a perception that the tax code significantly increases agricultural production, but the perception greatly overstates the fact.

Agriculture is in tough financial shape now, and many are looking for the causes of the financial crisis. The tax code is an inviting, but improper, target. The crisis can be more directly traced to the federal agricultural programs and to general economic policy than to the tax code.

Where abuses exist because of the tax code, the abuses must be stopped. However, the effort to eliminate all provisions of the tax code that are suspected of offering someone a "shelter" is getting in the way of meaningful, constructive tax reform for agriculture. Those who would use the tax code to eliminate investment in agriculture are as misguided as those who use the tax code as the reason for investment in agriculture.

Many of the potentially abusive tax shelters in agriculture will be eliminated by basic provisions of tax reform. Lower tax rates reduce incentives to shelter income from taxes. Eliminating the investment tax credit and slowing down depreciation remove two significant factors that may attract capital investment for tax purposes. Beyond these broad provisions, an effort is being made to target remaining abusive tax shelters through specific changes to the tax code.

Effects of the Tax Code

Range users must consider two aspects of taxation. First, and most significant, are provisions relating to livestock. The second category includes provisions relating to rangeland improvements. Changes are being considered in both areas under the tax reform proposals.

The livestock provisions have the largest impact because they are less manageable. For example, expenses prior to the time an animal becomes productive (that is, has a calf) must either be deducted or capitalized and depreciated. The question is not whether a rancher will bear the expense, but rather how the expense will be shown for tax purposes.

Rangeland improvements, on the other hand, can be delayed or just not undertaken, in order to avoid adverse tax consequences of the expenditure.

1/ Chairman, Tax & Finance Committee, National Cattlemen's Association, Ft. McKavett, Texas.

Obviously, some improvements must be made if the ranch is to continue to be viable, but timing of the improvement is manageable. For example, metal stocktanks qualify for depreciation, as does fencing. Both expenses can be timed to take advantage of economic conditions given tax policy.

Again, the decision should not be made because of a particular tax provision. Instead, the decision should be based on its own economic merits, and then structured to accommodate the tax code. Minimizing the tax burden is a reasonable business decision. Eliminating the tax burden through tax gimmicks is not.

Specific Reform Provisions

You might reasonably ask how tax reform is going to affect you in these areas--on livestock and on resource management. Well, if amendments recently approved by the House Ways and Means Committee are any indication, tax reform should be constructive for range users.

That is not to say our tax bills will not increase--they might. However, the tax code will be simpler and it will cost us less to comply with the code. Further, some of the changes actually encourage better range resource use.

Let me briefly review some of the changes:

1. Land clearing expenditures will no longer be deductible. Instead you will be required to capitalize such costs and add them to the basis of the property. However, normal expenses such as brush control to optimize grazing value will continue to be deductible in the year the expenses are incurred.

2. Under current law, up to $5,000 in soil and water conservation expenditures can be deducted under a special expensing provision. This provision is continued by the amendments, but such conservation projects must be under a plan approved by the Soil Conservation Service or a state agency. This provision is designed to encourage practices that enhance the use of land in its optimal state, e.g., for grazing. However, it will discourage such practices as breaking and leveling erodible land.

3. Under current law, agricultural real estate qualifies for capital gains treatment upon sales. However, some have argued that this promotes breaking rangeland up for crop production. The proposed amendment will prohibit capital gains treatment for income from the sale of highly erodible land or swampland that has been converted to crop production. The provision uses definitions contained in the "sodbuster" and "swampbuster" sections of the farm bill. Also, land used for grazing livestock will not be affected; that is, it will continue to qualify for capital gains treatment.

These three provisions should encourage conservation and minimize conversion of rangeland to crop production. Both effects are constructive for range resource users.

There are also three provisions that will affect taxation of livestock, particularly cattle:

1. Cash accounting will not be restricted, as was proposed by the President and the committee. The proposal was to require operations with sales over $5 million to use accrual accounting. We opposed this arbitrary standard as an unreasonable restriction on the use of cash accounting that has no basis other than size and the Treasury's desire to raise revenue.

2. A compromise was necessary on the preproductive period expense issue. Under the President's proposal we would have been required to keep track of all expenses incurred for cattle, from the time of conception, through birth and weaning, to the time the cattle re-entered the breeding herd. The paperwork involved in this exercise would have been a nightmare.

However, the provision was a "revenue loser" by Treasury and Joint Tax Committee estimates, so a way to offset that revenue loss was needed. The compromise is roughly as follows: Producers will elect to either (a) deduct these expenses

when incurred but depreciate all assets as a straightline rate over useful economic life, or (b) capitalize these expenses but use a more rapid, 150-percent depreciation rate.

This compromise allows one to choose a simpler system, one that may occasionally cost a little more, or a complex system that may cost less. The savings in accounting costs will likely offset any tax increase.

3. Capital gains was retained by the committee, but only part of the income from sales of section 1231 assets like livestock will be taxed at lower capital gains rates. Any previously deducted amount such as depreciation will have to be recaptured.

We are working to establish a simplified standard cost amount to be recaptured. Note that this recapture idea is a lot like the present recapture provision on depreciation.

Finally, our alternative was no capital gains. Most agricultural producers want at least partial retention of capital gains, which the amendments provided.

In general, the tax treatment of cattle you put on your rangeland will be the same as the present law. In fact, if you elect to deduct preproductive period expenses and use straightline depreciation your taxes will be easier to figure. This set of changes adopted by the committee is a reasonable and positive step for tax reform. Users of range resources should feel comfortable with these changes.

However, tax reform is not completed. The House Ways & Means Committee has many provisions yet to discuss, including depreciation, the tax rates, and an alternative minimum tax system that could cause us particular problems. We have a lot of work to do yet before a constructive tax bill is achieved.

NONMARKET VALUES IN RANGE MANAGEMENT

By Dale A. Jones[1]

For those who have been trying to improve the status of "nonmarket" natural resources in land management programs, the current unfavorable economic conditions for natural resource commodities sold in the marketplace are turning out to be the catalyst needed to get that story told.

Everyone is looking for answers. The public land manager is faced with economic justification of budget proposals; and with high costs and poor markets, private landowners need all the help they can get just to make ends meet.

If this meeting had been held last November, I could have opened my talk by saying, "I am from the Government, and I am here to help you!" But this year, my only occupation is producing alfalfa and associated wildlife from 8 acres of fertile Rio Grande valleybottom soil south of Albuquerque, New Mexico. I am also a great Willie Nelson fan, so that cannot be too far from qualifying me as one of the "good old boys."

But all kidding aside, these are tough times for many of you, and although the Government will not bail you out, I do believe that fish and wildlife and some of the other nonmarket resources can.

Nonmarket values are important to public land, which takes in about 44 percent of the rangelands, as well as to privately held range.

Although the problems are similar for public and private lands, the approach in using nonmarket resources is somewhat different for each of these two categories. Let's take the public lands first.

I recently participated on a committee for the Society of American Foresters to address the "below-cost timber sale" issue. You may wonder what that has to do with the problem before us today; but in many ways, the economic pressures involving timber and range on public lands are quite similar.

Multiple-use management has been the philosophical backbone for the treatment of most public lands for some time. Today an ever-increasing segment of the public disagrees with the balance of resources presented in multiple-use programs and plans. This "balance" problem seems to have intensified as emphasis was given to producing commodities. Funding became commensurate with receipts flowing back to the federal coffers. Nonmarket resources such as wildlife and fisheries did not fare too well under a policy that emphasized dollar benefits. As a result, the supporters of nonmarket resources began playing the "economic justification game" back in spades! Critics found that when the costs to the Forest Service of selling individual timber sales were calculated, the revenues generated by many sales were below the costs of those sales. As a result of these complaints and a report by the Government Accounting Office, Congress mandated that the Forest Service develop and install an accounting system that shows all costs and benefits of timber sales; not just revenues flowing from the sale of timber, but benefits associated with nontimber resources such as fish, wildlife, and forage.

In public rangeland ecosystems we also face a similar "below cost" situation. Although grazing permittees are the only group paying anything for the range resource they are using, costs of range management program administration substantially exceed receipts to the Treasury. I'm going to step around the fair market grazing fee issue in this presentation because I want to concentrate on the "other costs" of single use grazing--I mean other resource production opportunities foregone! Because the grazing permittee is paying a fee he has disproportionate political clout in influencing how public rangelands are managed. He gets no economic benefit from the fish, wildlife, recreation, and watershed resources on these lands, nor does the administering agency. So in the minds of many, the management balance of rangelands tends to become skewed in favor of livestock rather than favoring true multiple use.

1/ Wildlife biologist, Albuquerque, New Mexico, and past president, The Wildlife Society.

I personally believe that the answer for public resource management is to quit trying to justify economically each individual resource activity such as a timber sale on the basis of receipts to the U.S. Treasury! "Multiple use" is the name of the game, so let's make multiple use prescriptions that encompass all resource benefits and their costs. And for economic justification, let's weigh the costs of producing all resource outputs against their total value to the extent that it can be determined. I will admit that mixing commodity and noncommodity resource values presents problems, but as long as use of these values is consistent, and values are not used competitively among resources to produce the greatest project present net values (PNV), we should be able to use "state-of-the-art" knowledge, even as it is being debated among economists.

Now let's move to private lands. This is undoubtedly the most important area of our discussion, if for no other reason than it is the biggest "share of the pie."

Here the answer is for landowners to recognize the full potential for profitmaking from all their resources. To attain this potential, attitudes and philosophies must change. I will admit such changes do not come easy, but I see them coming. I worked 9 years for a state fish and wildlife agency and can testify from personal experience that it runs "cross grain" to support private enterprise making a buck off public fish and game resources, and yet, for the agency holding the primary responsibility and advocacy role for fish and wildlife, it makes little sense for state fish and wildlife agencies to "fight" the major potential of making that resource "numero uno." In order to gain that status, investments in habitat restoration and maintenance and changes in agricultural practices on private lands are necessary. There is some welcome recent evidence that positive attitude changes are starting to develop among the State agencies.

Landowners also need to make some attitude adjustments. The "I'd rather close my property than be bothered by those city bastards" has to give way to a more tolerant posture if we are to realize the full potential from our lands. Fish, wildlife, recreation, or any of the other so-called nonmarket resources, have a role to play in management plans for private lands. The key to managing these resources for revenue is to offer a high-quality use experience with other services and attributes that are not easily obtained on public lands. Providing such an experience will only come with concerted planning, probably the outlay of dollars for development of habitat and facilities, and, in the short term, through commodity production revenues foregone by adjusting ranching practices to enhance and sell the total output of all resources.

Right now there is revenue to be made through developing and selling hunting and fishing experiences, opportunities for birdwatching, and nature photography, camping, archeological exploration, rock hounding, and many other recreational pursuits. Just use your imagination and develop the resource potential of your land!

Each of you has different needs and objectives. I was talking recently with a landowner who told me, "If you wildlife folks could just show me how I could add $2,000 to $5,000 on to my annual ranch profits, I would be kissing you on both cheeks." There is a real need for states to employ extension specialists to help landowners recognize their wildlife and fish resource potentials and to assist them in planning how to capitalize on them.

Any program takes some marketing. But I will bet that a simple advertisement in one of the many hunting, fishing, or conservation magazines will do wonders if you have a quality experience to offer on your end of the line.

Don't worry if your place is small. The Hummingbird Ranch has an annual waiting list--that's right, a waiting list--of people who are willing to pay to observe hummingbirds! Also, where hunting activities demand more acreage than you have, consider cooperative arrangements with your neighbors.

You probably know more success stories than I do, but let me close with an outstanding example I was privileged to visit last year in Utah. It's a

unique ranch in that it consists of just over 200,000 acres of deeded land. It's called the Deseret Land and Livestock Company. It recently changed hands and is now owned by the Mormon Church. The manager has only one charge, and that is to make money. He happens to be a professional range manager, and so has added his own goal of improving the condition of the land at the same time he is turning a profit. His resources, in addition to the land and many miles of streams capable of producing trout, include 8,000 sheep, 12,000 cattle, approximately 4,000 deer, and 2,000 elk.

He has been a disciple of the "Savory Grazing Method" for at least 8 years and has employed the holistic concept to improve range and water conditions and to create the wildlife habitat that has seen his resource base expand from 4,500 to 12,000 cattle; 7,300 to 8,500 tons of hay; 350 to over 2,000 elk, including bucks averaging 2 to 5 points; muddy to clean runoff; and 4 new perennial streams. All this he accomplished with a reduction in employees, from 20 to 13. The bottom line is that land management and rigorous administration of a grazing system works!

Because wildlife and fish resources have the greatest short-term potential for improvement, land management objectives center around producing high-quality habitat and water. The ranch has gone from a cow-calf-sheep operation to a cow-calf, yearling, leased grazing, sheep program; from a deer-oriented wildlife program to a deer, elk, antelope, fish, wildlife program. Further, the ranch has added dirt contracting, gravel sales, mineral exploration, native-seed farming, land reclamation work, and quality brood mare production to its economic base.

As far as the economic return from hunting is concerned, the ranch receives $200 for cow elk, $500 for spike bulls, and $5,000 for trophy bulls. They have a $600 and $1,000 nonguided and $3,000 guided deer hunting.

The public benefits of improved ranch management are also worth noting. Hunting around the ranch property has significantly improved, clear water from this land is now entering downstream public reservoirs, and of the 1,000 elk that have been recently transplanted in the State of Utah, 600 have come free of charge from the Deseret properties.

Yes, nonmarket resources do have values that can help the private landowner economically and socially. Recognition of these values can also upgrade the importance of nonmarket resources in multiple-use planning and administration for public land. Timing is critical to the success of any program. The time for this one is now. All it takes is some cooperation and energy and we can make it happen!

UTAH'S AGRICULTURE RESOURCE DEVELOPMENT LOAN PROGRAM

By Stephen T. Gillmor[1], Kyle R. Stephens[2], and James A. Paraskeva[3]

We welcome the opportunity to acquaint the National Range Conference with Utah's model program for rangeland development--the Agriculture Resource Development Loan Program.

The genesis for this program was the need to improve our rangelands, watersheds, river drainages, and farmland, all of which are interdependent.

Of Utah's 52 million acres, 48 million are classified as rangeland, varying from fragile desert ranges to lush mountain greenery. The bulk of this rangeland requires improvement and rehabilitation.

Utah has the largest number of migrating sheep of any state in the Nation. The sheep operations use BLM (Bureau of Land Management) and state lands located on desert winter ranges, moving to summer forest permits and private ranges, coupled with base properties of pasture and crop production.

Sheep and cattle produced on rangeland are Utah's most important agricultural commodities. Production ranges from high-quality feeder calves and lambs to choice-grade fat lambs that go to slaughter directly from our mountain ranges.

Obviously, rangeland, and the agricultural production therefrom, are the most important factors for the economic health of all the range states.

In 1976, Utah developed a rangeland loan program that provided a quarter of a million dollars in interest-free loans. The credit requirements were very cumbersome. The loans had to be guaranteed by a "clear title" mortgage of the land, which greatly restricted the number of qualified applicants. (Among the first applicants were two attorneys whose secondary interests were agriculture.) However, a good foundation had been laid, though we greatly needed to broaden the scope and application of the program.

In 1983, the Soil Conservation Commission presented to our governor a plan to address the conservation needs of our state in the face of declining federal funds, adverse economic conditions for agriculture, and the window of opportunity to leverage loan funds with matching ACP (Agricultural Conservation Program) funds and SCS (Soil Conservation Service) engineering and planning services.

We then had to convince our legislature that conservation is everybody's business, that we share mutual benefits derived from its sound practices, and that a revolving loan fund bearing low interest would be a great resource to our state and not a subsidy to agriculture. And so, in 1983, we were successful in expanding the rangeland loan program to include installation of soil and water conservation practices for all agricultural lands but with emphasis still on range projects.

The goal of this Agriculture Resource Development Loan (ARDL) program is to have $80 million of conservation practices on the ground at the end of the 20-year program. This would involve a revolving loan fund of somewhere between $20 and 30 million. The fund currently stands at $14.2 million with $13 million of that being state appropriations and $1.2 million received in repayments since 1976. The cost to the applicant is a one-time 4-percent administration fee and a 3-percent annual interest rate with a maximum loan life of 12 years. The loans are available for rangeland development, cropland conservation, watershed protection, onfarm energy projects, and emergency protection of agricultural land. All practices under the loan program are restricted to private and state lands.

1/ Chairman of the board, National Wool Grower's Association
2/ Administrator, Utah Agriculture Loan Programs.
3/ Program coordinator, Utah Department of Agriculture.

Accomplishments

Rangeland development

In calendar years 1976 through 1984, the ARDL program and its predecessor accomplished the following on rangeland:

Practice	Private Land	State Land
Chaining	24,678 Ac	9,405 Ac
Plowing	20,470 Ac	3,185 Ac
Spraying	32,798 Ac	400 Ac
Burning	8,630 Ac	1,100 Ac
Reseeding	45,006 Ac	11,135 Ac
Fencing	308 Mi	16 Mi
Water Development	189 Projects	12 Projects

The increased carrying capacity on the improved rangelands ranges from 13.5 percent to 450 percent. Also, when taking into consideration water development and fencing projects, the actual number of rangeland acres benefited is substantially higher because of better distribution and use of the forage.

Cropland conservation

The types of cropland conservation projects involved include irrigation mainline delivery systems, pressurized irrigation lines, gravity-flow irrigation lines, cement-lined ditches, regulating reservoirs, hand lines, wheel lines, pivot systems, pasture fencing, permanent pasture planting, land leveling, weed control, fertilization, and drainage. As of June 30, 1985, these practices had improved or benefited 6,751 acres.

Watershed protection

The types of watershed protection practices involved include the following: pressurized irrigation pipeline to reduce soil erosion from flood irrigation, animal waste-control facilities, brush control, reseeding to improve vegetative cover, spreader dikes to control runoff, and terracing systems. As of June 30, 1985, these practices had benefited 15,647 acres.

The priority watershed program has gained the support of SCS, Utah's Division of Wildlife Resources, local counties, and state and local water-quality agencies.

These projects have resulted in multiple benefits to the watershed area. Water quality has been improved through the control of animal wastes and sediments; streambank erosion has been controlled by the placement of rip-rap; and streamside vegetation and runoff waters have been reduced through increased infiltration of water into improved rangelands.

Onfarm energy

As of June 30, 1985, the ARDL program had approved energy projects that include the installation of a water wheel with an online generating system, other small online electrical generating systems, and the purchase of minimum-till equipment.

Emergency protection

As of June 30, 1985, the ARDL program had funded projects that have helped to rehabilitate approximately 7,280 acres of agricultural cropland involved in 1983 and 1984 flooding. The types of practices include drainage systems, repair and/or replacement of cement ditches, hand lines, wheel lines, debris basins, terraces, pasture fencing, debris removal, land leveling, diversions, channel stabilization, headgates, farm accesses, and streambank protection.

Loan Statistics

ARDL had provided 473 loans as of June 30, 1985. These loans totalled $11,061,687 and averaged $23,386 each. We currently have loans in 37 of Utah's 39 soil conservation districts (SCD's) and 28 of the 29 counties.

Conservation practices eligible for funding under the program are essentially the same as those eligible under ACP run by the U.S. Department of Agriculture's Agriculture Stabilization and Conservation Service. These practices were adopted by the State Soil Conservation Commission with only slight modifications. It was felt that the broadest set of practices should be made available for selection. Local SCD's determine which activities are necessary and appropriate for their area.

Organizational Structure and Philosophy

The program's early success was due to two critical factors. First, it was decentralized so that resource needs are determined locally. This gives the program grassroots support and uses the potential of local SCD's as resource managers. The second critical factor was SCS's support. The state and local officers of SCS totally supported the program and agreed to provide technical assistance as part of their support for the SCD programs. SCS participated in the development of program guidelines and is an ongoing partner in program activities.

Early in the program, the commission recognized that local SCD's represent a valuable and underutilized resource. The district supervisors are most aware of the resource needs for their respective areas. Rather than add to state staff for program administration, the commission turned to the local SCD's.

The SCD's pooled their resources through the Utah Association of Conservation Districts (UACD) and created a framework to help administer the program. The state is divided into six zones and each zone comprises six or seven SCD's. Loan funds are allocated to the zones by the commission, based on resource needs. The zones in turn allocate funds to SCD's. The SCD's are responsible for receiving and processing applications, approving plans, and monitoring projects. A local supervisor is assigned to monitor each project.

In an effort to assist the zones and SCD's, the UACD employed three regional coordinators. These coordinators provide staff support for the loan program and other educational resource activities of the SCD's. The state did not increase its staff. The 4 percent administrative fee is distributed as follows: 1 percent to the state for program administration, 1 percent to the SCD in which the loan originates, and 2 percent to UACD for the regional coordinators.

Our philosophy is cooperation, coordination, and consideration. In addition to our own program, we have coordinated programs with other state agencies. For example, we worked with the Utah Division of Water Resources on irrigation projects that take the water from its source down to the individual farm units.

Wildlife interests are involved in all our rangeland seeding programs. We are concerned with appropriate plant varieties, natural random habitat left for cover, and the establishment of permanent vegetative cover for erosion control and upland game-bird production.

In cooperation with our land-grant college, Utah State University, we have funded applicable research on such subjects as minimum till, purchase of no-till drills by conservation districts, water management, purchase of neutron probes and data pods, and development of land classification data through remote sensing. This has amounted to over $200,000 annually since 1983.

Through this cooperative effort, the program as also been able to acquire other grant monies to assist in the groundwork and development of the program. Over the past couple of years, SCS has provided $120,000 in grant monies to UACD to help implement the ARDL program at the SCD level as well as help implement salinity control programs, common data banks, etc.

Summary

Our program is successful in getting conservation on the ground. Improving our natural resources benefits all segments of our society, rural and urban alike. The improved techniques of husbandry provide increased yields from our lands, which ultimately improve the economy of agriculture and our rural communities.

We now have more loan applications than available funds. In our opinion, we have a model program. We would like to share it with other states.

ECONOMICS OF RANGE MANAGEMENT TODAY: SUMMARY

By Leonard U. Wilson[1]

At the outset, I should state what I conclude from the presentations of the members of the panel on the Economics of Range Management Today:

- o The range cattle industry will continue to be a significant element of American agriculture
- o Good managers are not going to go broke

Members of this panel spoke from a wealth of experience and wisdom. Collectively, they represented cattle ranching, sheep ranching, wildlife management, banking, federal and state government, organization leadership, and teaching.

Our moderator was Dr. John Fedkiw, Office of Budget and Program Analysis, U. S. Department of Agriculture. Members were "Dub" Waldrip, a Texas rancher and past president of the National Cattlemen's Association; Jimmy Powell, a Texas banker and chairman of the Tax Policy Committee of the National Cattlemen's Association; Dale Jones, former wildlife biologist with the U.S. Forest Service and past president of the Wildlife Society; and Stephen Gillmor, a sheep rancher, president of the National Wool Growers Association, and former Commissioner of Agriculture in Utah.

The four speakers were faithful to the theme of this conference--Opportunities for the Future. There was no glossing over the fact that these are tough times for the range cattle industry. No one suggested that prosperity was just around the corner. Nevertheless, the tone was upbeat.

The framework for the discussion by this panel was set by many of the speakers at the Conference Overview. They pointed out that American agriculture is in an extended period of economic adversity and that the range cattle industry has been particularly hurt by--

- o The decline in beef exports
- o The decline in domestic market share for red meat
- o The continuing rise in the costs of production
- o Diminishing federal assistance
- o Growing conflict over land and resource uses

Despite this situation, members of the economic panel spoke from confidence in the resiliency of the industry. This is an industry that has often overcome adversity in the past. In fact, Dub Waldrip could say that his greater problem was not the business "climate," it was the climate "climate." His part of Texas has had a 3-year drought.

In my own order and language I am now going to provide what I think were the highlights of the panel discussion.

I'll start with the federal tax issue. Jimmy Powell emphasized that general economic policy and federal agricultural programs, not tax structure, were to blame for the current state of agriculture. He also cautioned that range management decisions should be made on their economic merit, not their tax consequences. But taxes are a significant cost of doing business and should be minimized to the extent consistent with sound management.

Major tax reform is being considered in Congress. We may see significant, constructive change--the first in 25 years. Under current proposals, figuring taxes will become simpler and less costly and the tax structure will favor better resource use practices. These proposals would eliminate the worst tax shelter abuses without discouraging investment in agriculture.

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Powell gives tax reform a 50/50 chance of Congressional approval. Members of Congress need to be told that reform is urgent, that people demand it. While the industry organizations work on the details to protect your interests in the package, you have to let your Congressional delegation know that you want action.

Turning to what's happening at the state government level, the economic sessions heard Stephen Gillmor describe Utah's rangeland development program. Gillmor's presentation was appropriate to one theme that kept coming up in these discussions--the need to increase range resource productivity to accommodate new and growing demands from nonmarket sources.

The State of Utah is demonstrating a successful approach to range rehabilitation and improvement. Its Agricultural Resource Development Loan program makes low-interest money available to farmers and ranchers. Those loans can be used for rangeland improvement projects, including water development. They can also fund cropland conservation projects, watershed protection, and onfarm energy development.

The revolving fund is now capitalized at over $14 million. The goal is to have $80 million in improvements on the ground at the end of the 20-year program. Already the program has an impressive list of accomplishments. Carrying capacity for improved rangeland has been increased as much as 450 percent.

The structure of the program has contributed significantly to its success. Decisions on resource needs are made at the local level. The program utilizes the soil conservation districts because these local organizations are where the resource knowledge lies. The support of the Soil Conservation Service through the Utah State office has also been an important factor. Cooperation, coordination, and consideration is the underlying philosophy of the program.

Utah's program demonstrates a role for state government initiative in assisting the range cattle industry as well as all range resource users.

Opportunity for private initiative was discussed by Dale Jones, who argued that ranchers can offer high-quality recreation experience of a type not available on public land. While hunting and fishing are the obvious activities ranchers can profit from, there are many other recreational assets that can attract birdwatchers, rock hounds, hikers, and other vacationers.

Ranchers need to recognize what they have to offer, learn how to develop this recreation potential, and market it as a quality experience. In doing so, they can also promote better understanding between ranchers and recreationists--to mutual benefit.

An outstanding example of development of nonmarket resource opportunities is the Deseret Ranch in Utah. If participants in this conference go away remembering only one thing, it should be that you can pay $5,000 for a trophy bull elk at Deseret Ranch. Since going into the recreation business, Deseret Ranch has not only made game-based recreation profitable, it has also vastly increased its market production and range productivity, both forage and wildlife.

I have left to last our first panelist, Dub Waldrip. He is the apostle of what I'd call opportunistic management, and he is a practitioner.

As I said earlier, he spoke more from the lessons of surviving a drought crises than an economic one. He stressed flexibility, i.e., that ranchers must be responsive to current circumstances in decisionmaking, on the range and in the marketplace. They must adjust and accommodate to constant change in range conditions and carrying capacity. And, they must adopt what I'd call a "no sacred cows" philosophy.

Planning and anticipation--not reaction--are keys. Innovation is another: innovation in breeding, nutrition, and marketing particularly.

The rancher must emphasize overall productivity: of the range, the herd, and the marketing strategy. He or she must put it all together.

Adopt a holistic outlook was a theme that Dale Jones later picked up in a broader sense. He said that we should quit trying to find separate economic justification for every range resource. We should look instead at the total output of values and benefits in planning to realize the maximum opportunity from range resource use.

Think about what the conference bumper sticker says--"America's solar-powered natural resource." Range is a richly productive resource with an enormous unrealized potential and opportunity for the future--for smart managers.

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THE RANGE ECOSYSTEM--AN OVERVIEW

By David M. Engle[1]

The range ecosystems of the United States are relics of the past that have not outlived their usefulness. They are sources of wealth for the present and reservoirs of opportunity and stability for the future. Whether we refer to them as range ecosystems, ranges, or rangelands, they stand in vivid contrast to other kinds of lands.

Very often, range ecosystems have been abused or misused because society has failed to recognize the fundamental characteristics that set range ecosystems apart from other kinds of ecosystems. Likewise, categorizing all range ecosystems as uniform in character has resulted in mismanagement that has improved neither the productivity nor the integrity of the range ecosystem. This overview outlines the characteristics that distinguish range ecosystems from other ecosystems and examines the relationship of the range ecosystem concept to range management. Range ecosystems in the United States will be compared on the basis of their extent, productivity, structure, function, patterns of community succession, stability, and resiliency.

The Uniqueness of the Range Ecosystem

The major terrestrial ecosystems of the world can be categorized as nonproductive, forest, agronomic, residential-industrial, and range (Lewis 1983). Among these terrestrial ecosystems, the range ecosystems are the most often overlooked and their contributions to humanity minimized. Range ecosystems, by definition, are neither agriculturally productive per unit area nor in danger of degradation in the absence of energy inputs necessary in agronomic ecosystems. While it is true that on an area basis range ecosystems generally produce few resources valuable to society, this does not mean they are unproductive ecosystems. In some cases, range ecosystems are considered productive, not on a per unit land area basis, but because of their immensity. In comparison, agronomic and other agricultural ecosystems are far more productive on an area basis; but without periodic infusion of energy-intensive inputs, these ecosystems degrade into far less productive and sometimes unuseful ecosystems.

The evolution of range ecosystems has been shaped largely by two factors that effectively describe the uniqueness of ranges, namely herbivory and climate. Grazing by large herbivores and periodic drought explain the presence of grazing- and drought-resistant vegetation on ranges. Rather than trees, range ecosystems are dominated by grasses, herbs, and shrubs at the highest order of development.

Forest (open forests) and agronomic (culturally maintained pastures) ecosystems can produce sizeable quantities of grazable vegetation and at times can be managed similar to range ecosystems. However, forest ecosystems eventually become closed forests with little suitable habitat for herbivores. Similarly, agronomic ecosystems eventually require major inputs of energy to maintain their integrity and productivity status.

Range ecosystems are also unique in the extent to which they are associated with uncertainty (Anderson 1979). There are numerous sources of uncertainty, the greatest and most obvious associated with vagaries of weather. In addition to weather, there are biological, ecological, economic, and political uncertainties that impinge upon range ecosystems.

Range ecosystems are also dynamic. It is inappropriate to think of them as static systems with little likelihood or room for change. To the contrary, range ecosystems evolve and operate in concert with all environmental factors, including climate, organisms, and geological influences, and eventually come to some sort of dynamic equilibrium with these environmental factors. Today, the environmental impacts on ecosystem

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function include the activities of man. There is no longer the fluctuating natural equilibrium that once existed before civilized man appeared as a factor in the ecosystem. We must now use another equilibrium as a goal for management of range ecosystems. In this equilibrium, man must be an active participant.

The prairie ecosystem is a good example of range ecosystem change from the prehistoric character. Fire was historically a frequent visitor to the prairies of the Great Plains. With fire suppression by European man, certain plants intolerant of fire have expanded their range and density. Eastern redcedar (Juniperus virginiana) has invaded and is rapidly increasing in density in areas of the prairie previously unoccupied by the species. Inadvertently, man has promoted a change in this ecosystem by changing the fire climate under which the ecosystem evolved.

The lesson for us today is that man has no choice but to become involved in the management of altered range ecosystems. Otherwise, the eastern redcedar and similar invasions will result in ecosystems with little value to man. An altered ecosystem now exists in almost every case, and equally important, there is no way to now return to a pre-civilization state in range ecosystems.

Man's presence as a factor in today's range ecosystems has been a two-edged sword. In most cases, lack of knowledge has led to degradation of the range ecosystem as resources were exploited. In some cases, overstocking with livestock has been responsible for changing the ecosystem, sometimes resulting in a dramatic, devastating change. However, change in range ecosystems has been wrought by many factors and this will continue into the future, requiring man to continue to adapt his management to meet the changes as well as the demands of society for whatever uses the ecosystem might be capable of providing.

The Range Ecosystem in Relation to Range Management

Ranges are ecological systems, or ecosystems, comprising living organisms (the biotic component) and their nonliving environment (abiotic component), which are inseparably related and interact upon each other (Tansley 1935, Odum 1971). The organisms include both plants and animals and the nonliving environment includes the elements of soil, air, light, etc.

The complexity of the range ecosystem with all of its parts and interrelationships is staggering. Yet unless the ecosystem is considered as a whole unit, a grossly inadequate management perspective results. It is, of course, presumptuous to expect those who deal in the management of range ecosystems to obtain a complete understanding of the interactions that take place in range ecosystems. However, a basic understanding of the principles that govern ecosystem processes are necessary for judicious management of the range ecosystem.

Management of range ecosystems is appropriately aimed at the ecosystem level rather than at a single component of the ecosystem. This principle has sometimes been extrapolated to mean that range ecosystem management should be multiple use and coordinated use of the range ecosystem rather than management concerned with one major use, i.e., livestock grazing. Range managers who derive an economic benefit from range ecosystems will be most concerned with the one or several most economically important uses of range ecosystems. Range management, as ecosystem management, will naturally perpetuate all or most resources whether there is one or several major uses. Otherwise, as the entire ecosystem becomes exploited and degraded because of the overuse of one or a few resources, there will be a decline in the potential for benefits derived from those resources as well as from other resources.

Because of the complexity of range ecosystems, there will always be many resources that will go unused. Management for all of these potential uses is impossible and unnecessary. It is necessary, however, for man to manage range ecosystems to derive sustained benefits from the use of a limited number of resources of importance to society.

Area and Ownership Patterns of Range Ecosystems

Because of differences in classification terminology and methodology, there are considerable discrepancies in area estimates of kinds of land and ownership patterns in the United States. Inventories generally agree that rangeland ecosystems are the major land type (about 50 percent) in the United States. If Alaska is included in the estimate, then rangelands comprise over 800 million acres (USDA 1980). Excluding Alaska, rangelands have been inventoried at 621 to 650 million acres (USDA 1980, 1982), but when open forests have been included as range, the total is in excess of 1 billion acres (USDA 1974). One USDA report places rangeland types as occupying more than 940 million acres in the 17 western states alone (USDA 1981).

Regional distribution and land ownership patterns are integral in a discussion of range ecosystem land area. According to estimates that exclude Alaskan rangelands, 97 to 99 percent of the U.S. rangelands are in the Great Plains and the 11 states of the arid and semiarid West (Off. Technol. Assess. 1982, USDA 1980).

Considerable variation in range areas exists between the Great Plains and the 11 western states and among states within these regions. For example, USDA (1980) inventoried rangelands in the Great Plains states in 1976 at over 170 million acres, just 27 percent of the western rangelands. Oklahoma was the Great Plains state with the least amount of rangeland, 9.3 million acres, and Texas had the greatest, 91.6 million acres. The Rocky Mountain states had slightly over 382 million acres of rangeland. Idaho, with 24.2 million acres of rangeland was the Rocky Mountain state with the least acreage, whereas New Mexico had the most with 59.8 million acres. These values differ from other published inventories, so their reliability is somewhat suspect, yet they do provide some relative values for perspective.

Oklahoma is an excellent example of the incongruity of such inventories. While the U.S. Forest Service classifies only 9.3 million acres of Oklahoma as rangeland (USDA 1980), the Soil Conservation Service (USDA 1982) included grazed forests (woodlands and noncommercial forests) in their inventory and classified 14.6 million acres in Oklahoma as rangeland in 1977. When the U.S. Forest Service estimates of grazed forest are added to the estimates of grazed rangeland, the total is just over 17 million acres in Oklahoma. Similar inconsistencies exist for other states and regions.

While the 17 western states are traditionally considered to be the range states, the southeastern states have considerable land area that is extensively grazed and considered by many to be managed like a range ecosystem, in spite of their transitional status to closed forest. Open, grazed forests in the eastern United States have been inventoried at 160 million acres (USDA 1974), although other estimates of grazed eastern forests are substantially lower (Off. Technol. Assess. 1982, USDA 1980).

Approximately two-thirds of the rangelands in the contiguous states are nonfederally owned (Off. Technol. Assess. 1982). About 25 percent are managed by the Bureau of Land Management, and about 7 percent are under the management of the U.S. Forest Service (USDA 1980). The remainder are lands managed as smaller individual holdings by an assortment of other federal agencies, including the Fish and Wildlife Service and the military.

Individual range ecosystems: area and resource importance

USDA (1980) broadly typed three range ecosystems by vegetation type: grasslands, shrublands, and other forest lands (chaparral-mountain shrub and pinyon-juniper). Grasslands were inventoried at 293 million acres, shrublands at 295 million acres, and other forest lands at 63 million acres. Of the grasslands, the plains grassland (175 million acres) and the prairie (41 million acres) ecosystem types in the Great Plains accounted for 216 million acres. The sagebrush type in the Rocky Mountain region accounted for 130 million acres of the shrublands. The three ecosystem types account for over half (53 percent) of the rangeland area of the contiguous states as inventoried by the USDA (1980). Other large range

ecosystems include pinyon-juniper (47.3 million acres), southwestern shrubsteppe (43.2 million acres), and the desert shrub (81.2 million acres).

Grazable forage is by far the most economically important resource use of range ecosystems in the United States. Range ecosystems differ widely in the amount of forage produced. The prairies are the most productive of the larger range ecosystems, with an average annual herbage and browse production of 3,300 lb/acre (USDA 1980). The plains grasslands and sagebrush ecosystems are intermediate in productivity, producing on the average about 1,000 lb/acre. The other large range ecosystems produce substantially lower amounts of forage: southwestern shrubsteppe, 490 lb/acre; pinyon-juniper, 380 lb/acre; and desert shrub, 250 lb/acre. The oak-hickory ecosystem of the eastern forest produces 1,150 lb/acre (USDA 1980).

Stocking rate information for the various ecosystems indicates that the two Great Plains ecosystems--the prairie (45 million animal-unit-months, or AUM's) and plains grassland (54 million AUM's) ecosystems--contribute over 50 percent of the 195 million AUM's of grazing on range ecosystems in the 17 western states (USDA 1980, 1981). The sagebrush ecosystem provides just under 25 million AUM's, while the desert shrub, southwestern shrubsteppe, desert grasslands, and pinyon-juniper provide less than a total of 12 million AUM's (USDA 1981). The eastern forest provides between 12 million AUM's (Off. Technol. Assess. 1982) and 53 million AUM's of grazing (USDA 1974).

It is quite likely there will be a shift in regional livestock production from grazed forages. While there has been an overall decline in cattle numbers in the United States since a 1975 peak of 131.8 million head, there have been regional differences in the magnitude of decline (Fedkiw 1985). Cow numbers declined the least from 1975 to 1984 in the 11 western states (10 percent) and the most in the eastern 31 states (22 percent). The four northern plains states lost 19 percent of their 1975 cow herd. Part of the greater reduction in cow herds in the Plains and the East may be attributed to increased cost of fertilizers that are used on intensively managed pastures and a conversion of some productive forage-producing lands into cropland (Fedkiw 1985). Even more reductions of eastern cow numbers are expected because of the profitability of tree crop production over forage use on pasture and range. With this eventuality, there will be an increase in demand for forage grazing on western ranges, yet certainly not of the magnitude--an optimistic outlook of 400 million AUM's by the year 2000--predicted a decade or so ago (USDA 1974).

Other than forage for livestock grazing, the range ecosystem provides other resources with considerable importance to society, including water, timber, wildlife, recreation, and scenic beauty. These uses generally take place along with livestock grazing. On federally owned lands, the multiple-use approach to resource use is a matter of regulation. Most of the BLM and National Forest lands are designated for multiple use; that is, no specific use is automatically assigned dominance (USDA 1980). While it is true that many private ranges are managed for a variety of uses, the overriding management concern is livestock grazing. Those lands outside of federal ownership can allocate more use to forage for livestock without compromising the public interest in conserving other range resources.

Descriptions of Range Ecosystems

Range ecosystems include grasslands, savannas, shrublands, productive deserts, alpine and arctic tundra, alpine communities, coastal marshes, and wet meadows. Derived grasslands, which are extensively managed, and open, grazable forest can also be considered kinds of rangeland ecosystems. Classification here is based on regional physiognomy, which is the species or group of species that appear to dominate an arbitrary grouping of range ecosystems. More detail in classification considers such factors as floristics or species composition, ecological relationships, successional status, and geographical characteristics of a region. Thus, range ecosystems composed of one or more major plant communities can be named variously. Range ecosystems are referred to, then, as range types, grazing regions, or range regions.

Characteristics of major range ecosystems have been summarized by Stoddart et al. (1975). As a part of the Forest-Range Environmental Study of the U. S. Forest Service, Garrison et al. (1977) presented descriptive sketches of 34 ecosystems of the 48 contiguous states. More recently, Branson (1985) described the changes that range ecosystems in the western United States have undergone in the past 100 years. I have relied heavily on these references for this section. Brief descriptions will be given for only four major range ecosystems for the purpose of briefly contrasting differences.

Great Plains grasslands

The prairie ecosystem. Also known as the tallgrass prairie and true prairie, the prairie lies between the deciduous forests of the East and the shortgrass plains of the West. It extends from Canada to southern Texas on the rather monotonous topography of the Central Lowland physiographic province. Because most of the soils are deep, fertile Mollisols, much of the 252 million acres has been converted to cropland. In most cases, only those areas with shallow or rocky soils have remained intact. Precipitation varies from nearly 40 inches in the east from Texas to Indiana and near 30 inches on the southwest to 20 inches on the northwest boundary. In general, precipitation is sufficient to allow very deep percolation into the soil. The ecosystem is dominated by the tallgrasses big bluestem (Andropogon gerardi), indiangrass (Sorghastrum nutans), and switchgrass (Panicum virgatum), with a rich mixture of forbs.

Prairie ecosystems outside of the Kansas Flint Hills and the Oklahoma Osage Hills are often small, broken tracts so they are used with agronomic ecosystems (perennial pastures, annual forage crops, and crop aftermath) in a combined forage-livestock production system. This is a more profitable combination than in other regions of the western United States because of less risk associated with low and erratic precipitation, yet the combination contributes to range deterioration since livestock are stocked according to the carrying capacity of the agronomic ecosystems rather than according to the carrying capacity of the range ecosystem.

The prairie is susceptible to woody plant invasion by a variety of species. However, overgrazed ranges do not appear to be any more susceptible to woody plant invasion than do those that are not overgrazed. The absence of recurrent fire appears to be the overriding factor in woody plant invasion. In fact, in the absence of either recurrent fire or annual grazing, the prairie tends to become decadent with overaccumulation of mulch in higher precipitation zones and burning and/or grazing may be necessary to maintain productivity.

livestock, or by wildfire
short-lived effects on pra...
disturbance, vegetation changes in rather predictable fashion to a dominance by species of lower stature that are less productive and palatable to livestock. However, little or no erosion hazard is associated with the lower successional stages. Furthermore, when woody plants or undesirable herbaceous plants become a problem, prescribed burning and/or herbicides can be used successfully to induce a rapid return to dominance by tallgrasses, often in the year of treatment. Deterioriated ranges will also recover, but not as rapidly, with deferred grazing and rest.

The plains grasslands ecosystem. By far the largest of the range ecosystems, the plains grasslands is composed of the mixed prairie in the East and the shortgrass prairie in the West. Extending from Canada to almost Mexico, this ecosystem occupies a broad belt of high land that slopes gradually eastward and downward in altitude from the foothills of the Rocky Mountains to the central lowlands, where it meets the prairie ecosystem at about the 100th meridian. The soils of the ecosystem vary from Mollisols in the east, to Alfisols and Aridisols in the south, and are often very fertile because of the absence of nutrient leaching. Annual precipitation, not nearly as reliable as that of the prairie, ranges from 10 inches in the north to more than 25 inches in the south. Species composition is influenced by a temperature gradient that increases from north to south and a moisture gradient that increases from west to east. This grassland is

dominated, especially in western areas, by shortgrasses, most often blue grama (Bouteloua gracilis) and buffalograss (Buchloe dactyloides). In central and northern portions, cool-season midgrasses compose an overstory to the shortgrasses. To the east, mid- and tallgrasses begin to dominate.

The native shortgrasses are tremendously resistant to heavy grazing, so under livestock grazing this ecosystem is highly stable. Resistance to grazing is attributable primarily to two factors. First, many of the grasses reproduce largely by vegetative means and do not have to rely on seed production for reproduction. Second, because of the low stature and concentration of plant mass near and below ground level, most of the grass plant escapes heavy grazing. These characteristics make the shortgrasses, in particular, extremely resilient. In fact, heavy grazing in the mixed prairie characteristically gives way to the lower successional dominance of shortgrasses as midgrasses are suppressed. It is possible, however, to graze heavily enough to limit even the shortgrass sod, after which weedy plants invade the open interspaces between plants.

Drought occurs frequently throughout the plains grasslands, and because of the intensity and lengthy duration, it is often difficult to completely separate the effects of grazing from those of drought. Perhaps the best documentation of vegetation changes with grazing and drought is available for this range ecosystem. Severe droughts of the 1930's and early 1950's resulted in such dramatic changes in the plains grasslands that they were often difficult to distinguish from cultivated fields because so little of the original plant cover remained.

Three main conclusions, drawn from the body of research data accumulated during and after the drought cycles that have occurred in this century, can be made regarding the stability and resiliency of the plains grasslands ecosystem. First, drought has a much greater effect on vegetation than does heavy grazing by livestock. Second, improvement in range condition is associated more with increases in precipitation than with decreases in grazing intensity. Finally, attempts at dryland crop agriculture continue on land unsuited to cultivation in the western Great Plains, with long-term consequences. The range ecosystems of the plains grasslands, once broken by the plow, are open to severe wind and water erosion. This problem becomes even greater with abandonment during extended drought. Stability and resiliency of the shortgrass plains are phenomenal insofar as grazing and drought are concerned; but, after the plow, the resilient grasses are lost and the plains grasslands ecosystem may take a century or more to fully recover.

The sagebrush ecosystem

Of the western range ecosystems, the sagebrush ecosystem varies greater in altitude and longitude than any other. It is prominent mainly on the Columbian Plateaus in the northwestern states; in the central portion on the Great Basin of Utah, Nevada, and southern Idaho; in the Wyoming Basin; and on the Colorado Plateaus and some of the adjacent mountains. Elevations range from 600 to 10,000 ft. In the Columbian Plateaus province and in a portion of the Colorado Plateaus province, the soils are generally Mollisols, characteristic grassland soils. Elsewhere are found Aridisols, Inceptisols, and Entisols. The precipitation of the region is generally low, ranging from about 7 to 15 inches annually. Most of this falls as snow, 40 to 50 percent from December to March. The sagebrush ecosystem vegetation is characterized by shrubs, primarily big sagebrush (Artemisia tridentata). The most important grasses are bluebunch wheatgrass (Agropyron spicatum) and Idaho fescue (Festuca idahoensis). Species composition of the understory is strongly influenced by soil physical and chemical characteristics and by livestock grazing. Both grazing intensity and kind of grazing animal have profound effects on the species composition.

Some uncertainty remains as to the original extent of dominance of sagebrush over the native bunchgrasses, especially in the northwestern and northern reaches of the ecosystem. Some hold that this area is climax grassland. Even recent studies disagree as to the precivilization nature of this ecosystem.

While the soils of the region are often grassland soils, the climate is not a grassland climate, which is characterized by a summer or growing season precipitation pattern. Further, historical documents tend to emphasize the ubiquitous presence of the sagebrush. Yet, under protection from grazing, grasses will eventually dominate. The most probable aspect of the potential of this ecosystem, then, would be more like a sagebrush savanna, one where bunchgrasses are interrupted by scattered sagebrush.

In contrast to the grasses of the Great Plains grasslands, those of the sagebrush ecosystem seem unusually susceptible to grazing. The bunchgrasses of the sagebrush ecosystem evolved in the absence of the influence of large, gregarious herbivores like the bison, so they decrease rapidly with severe defoliation. The void left by bunchgrasses is then filled by unpalatable shrubs and exotic annuals that evade grazing. All in all, the sagebrush ecosystem appears destined to, at best, a codominance of shrubs and perennial grasses, even in the absence of domestic herbivores. However, with currently available range management technology, a stabilized ecosystem can be maintained. But, even with proper management the sagebrush ecosystem is less stable and less resilient than the Great Plains grasslands.

The desert grasslands ecosystem

Lying above the desert shrub ecosystem, the desert grasslands ecosystem once occupied vast areas of the elevated plains or tablelands in the Colorado Plateaus Province in Arizona, New Mexico, and Utah and the plains of the Mexican Highland section in the trans-Pecos area of southwestern Texas. These high plains tablelands are dissected by rough drainages or canyons. Elevations range from 300 to 7,000 feet. The soils of the region are Entisols and Aridisols that lack horizonation and are rarely moist for as much as 3 consecutive months. Precipitation is quite low, 8 to 12 inches along the lower elevational borders of the true desert and as much as 18 to 20 inches in the higher elevations of the northeastern and eastern parts. The season of precipitation varies from the Great Plains type (summer) in the east to the Pacific type (winter) in the west, with a combination of the two (late winter and late summer) in a broad central zone. The original vegetation was dominated by a diverse mixture of sod-forming shortgrasses and low-stature bunchgrasses. The shrubs that now dominate most of the desert grasslands ecosystem were present in only scattered small amounts. The major shrub species are creosote bush (Larrea divaricata), tarbush (Flourensia cernua), and mesquite (Prosopis glandulosa).

The desert grasslands ecosystem is considered in this discussion because of the contrast it presents with the previously discussed ecosystems in terms of stability and resiliency to use, particularly livestock grazing. Of all the range ecosystems, it is likely that the desert grasslands have changed and continue to change most dramatically and irreversibly from their original character. Where palatable and quite productive perennial grasses once dominated, there is now a profusion of unpalatable brush and annual weedy species.

Explanations for the tremendous increases in density of shrubs usually cite overgrazing by livestock, whereas some believe the primary cause to be an absence of previously naturally occurring fire that maintained the grassland. Others have suggested that the vegetation change can be explained by a change to a drier climate, by increased rodent activity and seed dispersal, or by combinations of these factors interacting with heavy livestock grazing and periodic drought.

There is good evidence that there have been some meaningful changes in climate, both unfavorable and favorable, in the last century. In either case, these changes can explain only a portion of vegetation dynamics in the desert grasslands. Continued heavy stocking by livestock must be recognized as the primary causal agent in desert grasslands deterioration. Perhaps interacting with climate change and absence of recurring fire, heavy grazing has resulted in encroachment and density increases in shrubs.

In any case, the desert grasslands under livestock grazing are not as stable as some other range

ecosystems, particularly the shortgrass plains and the prairie. Of even more importance is the lack of resiliency in the desert grasslands. Loss of topsoil has accompanied the loss of perennial grasses, so the inherent ability of the system to revert to grassland appears low.

Conclusions

To conserve the resources provided by range ecosystems, some essential principles must be followed. Ecosystem managers and policy makers must adhere to the principle that range ecosystems are unique and, as compared to other kinds of ecosystems, must be managed in uniquely different ways. Perhaps just as important are the considerable differences that exist among the different range ecosystems.

Range ecosystems differ greatly in their extent, their structural and functional characteristics, their patterns of community succession, and their stability and resiliency under disturbance. The differences among range ecosystems highlight different potentials to provide products and values for society. The more arid range ecosystems, which may be less stable and resilient under livestock grazing than the range ecosystems in more humid regions, are also much lower in forage production potential. Even enormous increases in productivity in the more arid range ecosystems would be of minor importance on a national scale, to say nothing of the implications of the stress to ecosystem integrity. Yet, the importance of these range ecosystems to local economies from ranching should not be minimized. However, expanded use of other range resources, such as recreation, in the less productive, stable, and resilient ecosystems can be accomplished without compromising ecosystem integrity.

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THE OFFSITE EFFECTS OF INADEQUATE RANGE CONSERVATION

By Edwin H. Clark, II[1]

The U.S. Department of Agriculture's (USDA's) National Resources Inventory (NRI) indicates that there are 414 million acres of nonfederal rangeland in the United States (USDA 1981). Figures from the Forest Service and the Bureau of Land Management indicate that there are another 220 million acres of federally owned rangeland (Schmautz 1979, Sheridan 1981). In total, rangeland accounts for 55 percent of the total land area of the 17 western states. Many have expressed concern about the deteriorating condition of these lands. The few studies providing actual data on rangeland condition show these concerns to be justified. The 1977 NRI, for instance, concludes that 60 percent of the private rangeland is in poor or only fair condition (USDA 1981). Less rigorous surveys of the public lands indicate that they are probably in worse condition (Schmautz 1979).

Much of the concern about inadequate rangeland conservation has focused on the onsite effects of deteriorating land quality. These include the elimination of native vegetation, destruction of valuable wildlife habitat, and long-term losses in the land's ability to support cattle raising and other economic uses.

These onsite problems may not, however, represent the most serious effects of current management systems. The land's degradation is also creating serious problems in areas sometimes far removed from the rangeland itself. A recent analysis of cropland erosion has indicated that the offsite costs of soil erosion, amounting to some $6 billion a year, may be significantly larger than productivity losses and other onsite costs that have traditionally been the major concern for soil conservation programs (Clark et al. 1985).

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The same may be true for rangeland degradation as well.

Causes of Problems

As on cropland, many of the of the offsite effects result from the excessive soil erosion associated with traditional rangeland management. As indicated in Table 1, the 1982 NRI estimates that sheet and rill erosion remove more than 560 million tons of soil a year from nonfederal rangeland in the 17 western states. Resources For the Future has recently estimated that another 105 million tons of sheet and rill erosion occurs on public rangeland in these states (Table 1).

Not all of this erosion is carried off the land. Much of it is redeposited at the bottom of the field from which it erodes, or as the water travels from the field where the erosion occurs to the nearest stream. In its study, Resources For the Future estimated that approximately 40 percent of this erosion is actually delivered to western streams. Various pollutants in addition to sediments are also carried into the streams by this erosion. These associated contaminants include degradable organic materials, bacteria and other organisms from livestock wastes, and salt. The pollutants may also include some nutrients and herbicides where these chemicals are used to promote forage production.

Sheet and rill erosion, however, are only one form of erosion occurring on these lands. The type of land use, the nature of the soils, and the characteristics of western storms all suggest that gully and streambank erosion are also likely to be serious. Because they are dry, contain a relatively low clay content, and have little vegetative cover, many western range soils are likely to be more susceptible to gully erosion than eastern lands. The sudden high-intensity cloudbursts that commonly occur in arid regions produce runoff patterns that are particularly likely to cause gully erosion. Any such gullies may be particularly likely to occur where cattle have worn paths or otherwise disturbed the ground near streams and watering holes.

Cattle knocking down the natural streambanks are also a major cause of increased streambank erosion. Unfortunately, the NRI makes no estimate of the amount of gully and streambank erosion that occurs on various types of lands. But anyone familiar with western landscapes is aware that these are common in that region. These types of erosion are likely to create proportionally larger offsite effects than the same amount of sheet and rill erosion because a much higher percentage of the eroded material is delivered to the stream.

Table 1. Estimated annual erosion on rangeland, 1982

(1,000 tons)

	Wind Erosion	Sheet and Rill Erosion	
	Nonfederal[1]	Nonfederal[1]	Federal[2]
Arizona	134,712	15,694	5,316
California	147,056	67,397	456
Colorado	12,156	63,493	18,300
Idaho	271	3,702	4,607
Kansas	6,879	24,056	27
Montana	806	36,026	3,507
Nebraska	13,020	26,516	24
Nevada	33,400	6,380	10,510
N. Mexico	133,691	41,480	3,879
N. Dakota	268	5,836	526
Oklahoma	575	29,183	12
Oregon	3,990	15,462	--
S. Dakota	77	23,098	624
Texas	61,765	115,426	86
Utah	51,095	17,970	31,020
Washington	581	5,526	--
Wyoming	7,109	63,136	25,854
Total	609,451	560,381	104,748

1/ Source: U.S. Department of Agriculture. 1984. 1982 national resources inventory. (Preliminary data, tables 16a - 24a.)
2/ Source: L. Gianessi, Resources For the Future, personal communication, December, 1985.

The other type of erosion that is particularly prevalent on western range land is wind erosion. The 1982 NRI, representing the first attempt to gain a comprehensive picture of the amount of win erosion occurring in the United States, indicated that the total wind erosion amounts to almost three-fifths of the total amount of sheet and rill erosion (USDA unpublished data). On nonfederal rangeland, the amount of wind erosion was 609 million tons per year--an amount greater than the amount of sheet and rill erosion. There are no estimates of the amount of wind erosion occurring on federal rangeland, but this is likely to be substantial as well.

Inadequate range conservation also causes the loss of habitat for wildlife. Under improper range management large mammals typically move out and small animal populations are often decimated. And where grazing animals destroy the riparian habitat, migratory birds and aquatic wildlife are often adversely affected. Again, there are no estimates of the amount of lost habitat, but the problems caused by these losses can, as indicated below, be significant.

Types of Offsite Effects

A number of different offsite effects can result from the problems caused by inadequate rangeland conservation. Aquatic wildlife communities can be seriously affected by water erosion, and both aquatic and nonaquatic wildlife can be affected by habitat destruction. These effects on wildlife, as well as others caused by water erosion, can significantly affect recreational opportunities. And the water erosion can also significantly affect water storage facilities and other instream water uses. Erosion by wind and water can impose costs on households, businesses, and public facilities.

The sediment can destroy spawning areas, food sources, and habitat; interfere with reproductive behavior; and directly injure fish, crustaceans, and other aquatic wildlife (Clark et al. 1985). In many western streams it is difficult to estimate how serious these effects may be. Because many of the streams carry large sediment loads naturally, the aquatic wildlife have tended

to adapt both physically and behaviorally to cope with a high sediment environment. Thus, for instance, they may reproduce during low-flow periods when sediment loads are likely to be lower. Nevertheless, streams such as Otter Creek in Nebraska have improved from a nonproducer to a major producer of trout after 3 years of excluding livestock from the banks (Platts 1979). Brown trout of Rock Creek in Montana were found to be 27 to 400 percent more abundant in ungrazed sections than grazed (Platts 1979). And in Big Creek, Utah, trout populations were 360 percent higher in ungrazed stream reaches than grazed (Platts 1979).

Less is known about the impact of reduced availability of riparian habitat on aquatic and nonaquatic wildlife. Streamside vegetation is often an important component of an acceptable fish habitat, providing shade, cover, and an environment suitable for insects the fish depend upon for food. This habitat can also be important for migratory birds and for other wildlife. Its destruction may not only eliminate this wildlife on the degraded land but may also reduce populations in other areas if those populations depended on the riparian habitat during part of their life cycle.

The deterioration of the terrestrial habitat can also have such offsite effects. Many animals have definite though largely unspecified territorial needs. If the available habitat is less than this critical amount, the animal is unlikely to survive in that location. In such cases, even if the rangeland represents only a a small amount of the animal's total habitat, its degradation may suffice to eliminate the viability of the remaining habitat for that species. In such cases the rangeland deterioration can have significant offsite wildlife effects.

The dynamics of wildlife populations can also cause this type of offsite effect. In order to remain viable, many species require a minimum population size. If habitat destruction causes the population to fall below this critical level, the species may be eliminated even though the degraded area represented only part of the population's total range. The problems caused by reducing available habitat or species populations below minimum viability levels are well documented by population biologists, but have been the subject of relatively little investigation with respect to western rangeland. Individual examples of wildlife impacts have been reported. For instance, the desert bighorn sheep apparently will not tolerate the presence of cattle within its habitat. In fact, as of 1977 there were no known thriving populations of bighorns where cattle were being grazed despite previous existence in the area (U.S. Dep. Inter. 1977). Many studies document the disappearance of bighorn populations after the introduction of cattle to an area. Occasionally these bighorn populations return when cattle are removed. Even so, the desert bighorn is now considered a threatened species.

All these impacts on aquatic and nonaquatic wildlife can, of course, significantly affect recreation opportunities. Recreational fishing is affected because there are fewer fish, and the fish that do survive may be of a lower valued species than the native fish and may be harder to catch because the suspended sediment interferes with the fish's ability to see the lure.

Other water-based recreational opportunities can also be adversely affected. Boating may be more difficult because of the increased sand bars, and less pleasurable because of esthetic nuisances and a lack of riparian vegetation. It can also be more dangerous because the silty water hides underwater obstructions. Swimming may suffer from similar problems of reduced attractiveness and increased danger. And hunting, of course, will be affected by reduced game populations.

Sediment affects water storage facilities by reducing their capacity, changing the temperature of the water, and providing increased opportunities for the growth of water-consuming plants.

Much of the sediment that enters waterways eventually finds its way to downstream lakes and reservoirs, where it settles permanently, taking up space that could be used for storing water. This lost storage capacity is particularly valuable in the West, and replacement storage is very expensive. There are few data on the rate of reservoir sedimentation in different parts of the

country, but an estimated 1.4 to 1.5 million acre-feet of reservoir capacity are silted up annually nationwide (Clark et al. 1985). A large portion of this capacity is in the western states, and a large portion of the sediment entering these reservoirs starts out as rangeland erosion.

Other western reservoir problems attributed to sedimentation are increased evaporation and transpiration. Sedimentation in New Mexico's Elephant Butte Reservoir was estimated to increase evaporation by 1,500 acre-feet annually (Clark et al. 1985). In Arizona's Roosevelt Reservoir the increase was estimated at 2,500 acre-feet annually. The sediment deposits can also provide a good site for plants that consume large quantities of water. Groundwater storage may be affected by degradation of rangeland. If reduced vegetation and compacted ground surface cause rainfall to run off the surface faster, there will be less recharge to the groundwater aquifers. This reduced recharge could create serious costs for areas such as Tucson, Arizona, that are dependent upon groundwater for both their drinking water and irrigation supplies.

Other types of instream effects that might be caused by sediment include increased wear on hydroelectric turbines and boat motors. However, there is apparently no documentation of any of these effects.

The frequency and seriousness of flooding, as well as the damages caused by floods, can be increased by sediment. The volume of the streamflow increases with suspended sediment. Sedimentation in the stream channel raises the stream bed. For example, in some arid regions such as West Pakistan, the river bed may actually be at a higher elevation than lands a mile or two away. Sediment in the flood water also frequently causes more damage than the water itself. In agricultural areas the sediment smothers the crops. In urban areas substantial costs are involved in removing the sediment from flooded property.

With better range management, flood levels should decrease. For example, consider the grazing management program implemented by the Bureau of Land Management (U.S. Department of the Interior) in the Rio Puerco basin (Van Haveren et al. 1985). The changes in grazing patterns, increases in vege- tative cover, and application of "best management practices" under this program should decrease surface erosion by 230 tons per square mile annually, thereby reducing flood peaks by one-fourth.

Sediment that enters waterways can also cause problems for households, businesses, farms, and public facilities that withdraw the water. If the water is to be used for drinking, the sediment and other contaminants have to be removed. Because dissolved salts are not removed by traditional treatment methods, they are carried into the supply to damage household appliances and water-using equipment in businesses. Sedimentation in canals can restrict the flow of water and increase the cost of canal maintenance.

Wind erosion can also cause serious offsite effects. Individuals can suffer health effects as the dust aggravates allergies and asthma; irritates the lungs, throat, and nasal passages; irritates the eyes; and possibly carries toxic substances into the respiratory system.

For instance, following a 1977 windstorm in the San Joaquin Valley of California, there was a dramatic increase in incidence of "valley fever" (coccidioidomycosis) in the San Francisco Bay and Sacramento areas (Sheridan 1981). This disease is contracted by breathing dust-borne coccidioidomycosis spores. (Humans are not the only ones that can contract valley fever disease. Soon after the windstorm, a gorilla and an orangutan in the Fresno Zoo died from it!)

Every dust storm significantly increases the risk of car accidents because it reduces visibility and sends drifting sand onto the highways. The dust also interferes with the enjoyment of all types of outdoor recreation.

Households suffer more rapid deterioration of exterior surfaces, landscaping, and automobile finishes. Automobile engines may also be damaged. At the least, filters will have to be changed more frequently. Household cleaning and laundry will also have to be done more frequently.

Businesses experience many of the same costs as households. Structures will have to be painted and the premises cleaned more often. Office and manufacturing equipment will wear out more frequently and require more maintenance. Some types of manufacturing establishments, such as manufacturers of precision equipment and electronic devices, may be reluctant to locate in areas having high dust levels.

Governments too will experience the higher costs of deteriorated coating on structures, increased cleaning costs, and increased equipment wear. In addition, highway maintenance crews have to spend additional money to remove drifting sand from highways and roadside ditches. Similarly, more money has to be spent on removing dust deposits from canals, swimming pools, water treatment plants, and other public facilities.

Cost of Damages

All these types of offsite damages resulting from inadequate rangeland conservation impose significant costs on society. Some of these can be clearly measured in additional expenses for paint or machinery maintenance. Others, such as human health or recreational effects, are more difficult to assign economic values to because they are not bought or sold in markets. Nevertheless, they clearly impose costs on the people affected. Still others, such as biological effects, are even more difficult to place values on because it is difficult to associate directly the type of effect and the resulting human cost.

Some efforts to place economic values on these effects have been completed during the past year and indicate that the economic costs may be very high. As mentioned earlier, The Conservation Foundation concluded that the offsite costs of all water erosion across the United States amounts to approximately $6 billion a year. Ribaudo (1985) of USDA's Economic Research Service adjusted these estimates to 1983 dollars and apportioned them to different regions of the country. He concluded that $3.2 billion out of the total of $7.2 billion in costs associated with all sources of water erosion were experienced in the 17 western states. According to the NRI, about one-third of the total water erosion occurring in these states (excluding erosion from streambanks, gullies, construction sites, and roads) is on rangeland. If these lands are responsible for the same percentage of the total costs, they would account for approximately $1.1 billion annually.

A more specific study was recently conducted of the costs resulting from wind erosion in New Mexico (Huszar 1985). This study was based on the results of a survey of households and businesses in the state which asked the respondents to estimate how much damage, if any, they were experiencing. The answer was $466 million annually, $402 million of which could be attributed to wind erosion of rangeland (see Table 2). This is equivalent to an average of $3.00 per ton of wind erosion from rangeland occurring in that state. If these New Mexico results were extrapolated to the 17 western states, the total costs would be $1.8 billion due to wind erosion of rangeland. There are clear problems with such an extrapolation. However, it appears more likely to be too low than too high. For instance, California, which has more rangeland wind erosion than any other state, also has much higher population and business densities than New Mexico. These higher development densities should result in significantly higher costs per ton of wind erosion that occurs.

Neither of these cost estimates takes account of the significant biological effects that can occur because of inadequate rangeland conservation. There is currently no easy methodology for placing economic values on such effects. Nevertheless, they may be among the most important of the effects. Just because of a number can not be assigned to a problem does not imply that it is unimportant.

But even ignoring the biological effects, the offsite costs of rangeland erosion are clearly significant. The very crude extrapolations of $1.1 billion for water erosion and $1.8 billion for wind erosion would suggest that those costs could well be in the range of $3 billion per year. And there are a number of reasons to think that they well might be higher.

Table 2. Average annual offsite costs of wind erosion in New Mexico[1]

(Millions of 1984 dollars)

	From All Sources	From Rangeland
Households		
Exterior Paint	2	
Landscaping	294	
Automotive	14	
Interior and Laundry	100	
Health	19	
Recreation	28	
Subtotal	457	395
Business		
Retail/Wholesale	4	
Services	4	
Manufacturing	--	
Subtotal	8	6
Highways		
State and County	1	1
Total	466	402

1/ Source: Huszar 1985

These estimates are only order-of-magnitude estimates; that is, the actual costs are more likely to be approximately in the range indicated than they are to be one-tenth as much or ten times as much. However, some potentially very significant costs have not been estimated at all. The costs of biological damages from both erosion and habitat deterioration are probably the most important of these.

These estimates pertain to the damages caused by sediment and related contaminants and are not estimates of the benefits that would result from sediment control. For several reasons, the benefits would be expected to be lower than the costs given here. Probably the most important is that no feasible erosion-control measures could completely eliminate all rangeland erosion. These lands have eroded since they were first formed and they will continue to do so, but the rate of erosion can be reduced. A second major reason relating to water erosion is that, if the sediment entering streams were reduced, the streambanks would tend to erode faster, compensating for that loss. Thus the sediment concentration in the stream would not be reduced by as much as the external sediment loadings, and many of the damages would continue. Eventually, the stream should return to equilibrium conditions with a lower sediment load, but achieving this new equilibrium might take many years. These and other factors will result in the benefits of soil conservation being lower than the costs of soil erosion. Nevertheless, it would appear as if these costs are large enough to justify a significant increase in erosion-control efforts.

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RANGE CONDITION AND VEGETATION MANAGEMENT

By Harland E. Dietz[1]

Early attempts to appraise rangelands initiated the development of what is known today as the "range site and range condition" method of inventory (Soil Conserv. Serv. 1976). This system is used by most agencies involved with rangelands, including the Soil Conservation Service (SCS), Bureau of Land Management (BLM), Extension Service, and Bureau of Indian Affairs. It is recognized by most university range departments and is accepted and used by ranchers.

Inventory Procedures

Range sites are ecological subdivisions of rangelands. They are natural ecosystems and are a product of all the environmental factors associated with their development, including soils, topography, and climate. Each site, therefore, differs from other sites in potential for producing range plants.

Range condition is the present state of the vegetation of a range site in relation to the climax plant community for that site. It is a comparison of the present vegetation to what could be and should be present.

For the past 40 years, SCS has used range site and condition in all inventories of the status of rangelands. Most recently, in response to a high degree of public interest in soil erosion, there have been efforts to determine resource management trends and even treatment needs by measuring erosion rates. This has proved effective on cropland, but it cannot be considered an accurate, reliable, or timely measure of range degradation. Everyone detests soil erosion and sediment and for good reason. Erosion problems should be corrected where feasible and reasonable. But, relying on soil erosion as a criterion for measuring rangeland degradation is comparable to a postmortem examination. By the time erosion becomes apparent, serious problems have already occurred. The first symptoms of range degradation are subtle changes in the plant community. Changes in surface condition of rangeland soils occur much later. It is important that the most timely and reliable indicators be used. Thus, we measure, monitor, and manage vegetation.

Range condition is based on the ecological principles of plant succession--that plant communities gradually change--moving through a number of sequences--finally attaining a relatively stable self-perpetuating community referred to as "climax." The plants comprising climax communities have withstood the test of time, the environment, and the elements for centuries. And, when degraded by overgrazing or any number of causes, the vegetation, if permitted through secondary plant succession, will trend toward returning to a composition similar to the original climax. Thus, climax vegetation provides an ecological standard for inventorying rangelands, whether on a national, state, ranch, or pasture-by-pasture basis. It becomes the foundation for decisions regarding management.

Inventory Results

Various attempts have been made over the years to get a "handle" on range condition or the qualitative status of the Nation's nonfederal rangelands. Two early attempts by SCS, in 1963, and again in 1977, were based on polling the state range conservationists for their calculated estimates of condition class percentages. Then, in 1982, SCS included a category for range condition in the National Resources Inventory (NRI). And for the first time, we have obtained measured data, statistically reliable at the state and national levels. The condition on the Nation's nonfederal rangelands was determined in this inventory to be: 4 percent excellent, 30 percent good, 45 percent fair, 16 percent poor, and 5 percent other (Soil Conserv. Serv. 1984). The "other" category mostly represents the annual grasslands of California. Assuming that good and excellent each represents a satisfactory state of condition, and both fair and poor a degraded

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condition, then we have a ratio of 34 percent satisfactory, and 61 percent unsatisfactory.

The 1977 estimates by the state range conservationists had a high degree of similarity with the measured data of 1982. Assuming that the 1963 estimate has a similar degree of reliability as the 1977 estimate, then a trend has been established. During this 20-year period, good and excellent condition has increased from 20 percent to 34 percent. The percentage of fair condition remained essentially the same. But, poor condition decreased from 40 to 16 percent. This would indicate that there is a slow, but gradual, improvement trend.

BLM range inventory data assembled in 1984 provided a similar ratio in range condition to that found on private lands; 36 percent good and excellent, and 60 percent fair and poor (Bur. Land Manage., no date). Their historic data also project a similar improvement trend for the past 20 years.

The Forest Service uses a somewhat different system, so a direct comparison cannot be made. However, in general, the ratio of satisfactory to unsatisfactory condition appears similar to that obtained by the other agencies (Forest Serv. 1980).

Treatment Needs

It is gratifying to be able to report an upward trend in condition. For one thing, it provides needed encouragement to the participants presently engaged in range management, whether it's on-the-ground application or research. Also, the public is reassured that progress is being made. However, despite this improvement trend, there is still the sobering fact that over 60 percent of our nation's rangeland remains in poor and fair condition.

The 1982 NRI data suggest that treatment needs on nonfederal rangelands essentially fall into three, nearly equal, groups. Roughly one-third, or 136 million acres, was considered adequately treated at the time the inventory was taken (Soil Conserv. Serv. 1984). Another 33 percent could be improved over time to a satisfactory condition through finesse in grazing management. This acreage can be improved while under use, by redirecting grazing programs to encourage proper use and better grazing distribution. Practices needed to accomplish this may include planned grazing systems, deferred grazing, prescribed burning, additional fencing, or water facilities.

The remaining one-third of the rangeland represents a much more difficult problem and will need intensive treatment before a satisfactory level of improvement can be expected. In addition to a careful grazing plan, this portion will require either brush control, range seeding, or erosion control measures. In many locations, combinations of these practices will be needed. Approximately 28 million acres, or 7 percent, need reseeding. About 19 million acres, or nearly 5 percent, were considered not feasible or not cost effective to treat (Soil Conserv. Serv. 1984).

The encroachment and thickening of brush emerges as one of the most critical rangeland problems. The 1982 resource inventory indicates that about 36 percent, or 145 million acres, have a woody canopy cover of 10 percent or greater. Sixty million acres have a canopy exceeding 25 percent, which represents a serious brush problem. It was projected, in 1982, that 81 million acres of rangeland were in dire need of some form of brush control. An additional 21 million acres of pastureland need brush control (Soil Conserv. Serv. 1984).

We have learned that range cannot be restored to a high ecological condition by quick, easy methods. There are few crash programs. Instead, it is accomplished through a gradual, patient process.

Range will be improved only as fast as individual ranchers develop a vision and a long-term commitment for improvement. By like token, effective technology will only be developed and transferred according to the commitment of agencies and groups responsible for these activities and the understanding and support of the public.

We are searching for opportunities for the future. Often, the best source of opportunities is determined by what has been most successful in the past.

What programs have proved successful over the years in furthering range improvement? There are many, including research, education, and cost sharing. But, the most effective and most lasting that I have encountered in the past 28 years in getting range conservation applied, have been accomplished through the soil conservation district's "conservation planning" techniques. I say this not from bias as an SCS employee, but because I have seen the method work over and over and prove its value. Planning is an essential step in bringing about needed changes. Through this technology transfer program, ranchers are provided one-on-one technical assistance and encouraged to develop and carry out plans for improvement. Mainly, planning has been successful because it brings into focus the resource inventory, desires of the ranchers, and available technology.

The value of conservation planning has been demonstrated many times. I would like to submit just one of the many examples. In the State of Kansas, a group of ranchers from a six-county area formed a Range-Forage-Livestock Committee for the purpose of range management and economic improvement. SCS assigned an experienced range conservationist to provide technical assistance to the group. In 2 years, 57 ranchers had developed plans for improvement. At least 40 had started rotation-grazing systems ranging from two-pasture systems to more intensive short-duration systems. Most were, for the first time, using prescribed burning to control brush. Overall, the program has been a success and is continuing. There are many similar examples throughout the country. The major key to such success is that range management received high priority.

From the National Resources Inventory, we have gleaned a general overview of the range resources--the present status and trend and, to some extent, even the magnitude of the problems remaining. So, where do we go from here? What action will be taken as a result of the inventories? If no action is taken, then it can be assumed there is either satisfaction with the status quo or that rangeland improvement is low on the priority scale. In 1983, only 7 percent of SCS technical assistance time was devoted to improving vegetative resources. However, rangeland practices were applied to 50 million acres, or 12.3 percent, of the Nation's total (Soil Conserv. Serv. 1985). What would have been the result if technical assistance time allotted to rangelands had been 15 or even 25 percent? The recent National Conservation Program has addressed this to some degree in calling for focusing efforts on improving range in poor and fair conditions (U.S. Dep. Agric. 1982). If the environment of shrinking funds for both research and technical assistance continues to exist, then the addressing and setting of priorities will dictate, or at least have a profound influence on, the level of future accomplishments on rangelands.

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RIPARIAN-STREAM MANAGEMENT

By William S. Platts[1]

Introduction

Upon settling this great nation, European man soon recognized the potential of using the vast rangelands for livestock production. Cattle were initially stocked in the early 1500's. Sheep arrived later. Animal numbers, however, did not peak until four centuries later. By the 1930's, livestock grazing was so heavy that many of these lands and the streams draining them were in poor condition. Because livestock are attracted to riparian areas adjacent to streams and lakes, that portion of the range was also heavily used.

As the land management agencies and private range owners improved grazing practices after the 1930's, rangelands began to improve. Busby (1979) states that rangeland conditions today are far better than the denuded, deteriorated ranges that existed in the early 1900's. I agree that rangelands have improved greatly, but contend, however, that studies leading to the interpretation of the improvement were based primarily on data collected from drier upland sites, and often did not take into account the condition of riparian areas (Platts 1979). Riparian areas may have recovered to some degree since the 1930's, but not nearly to the extent of other rangeland types. The reason for this is that we were not concentrating on managing riparian habitats--we were managing conditions on a large scale.

Riparian habitats are productive and quite resilient. Even degraded habitats, under good management, can soon recover and contribute valuable multiple rangeland resources to the Nation. The possibility exists to manage the Nation's rangeland's to increase fish populations by one order of magnitude during the next several decades. This article briefly, and in a generalized fashion, describes the past and present situation in riparian-stream management and offers some suggestions of methods to move toward better riparian management.

Situation

It is clear from the literature that improper livestock grazing can affect the riparian-stream habitat by eliminating riparian vegetation, widening stream channels, causing channel aggradation through increased sediment transport, changing streambank morphology, and lowering surrounding water tables.

Appraisals by the Bureau of Land Management (BLM) and Forest Service show that riparian lands are still in need of improved management. The BLM estimated that of their 536,825 acres of riparian habitat 447,473 (83 percent) were in unsatisfactory condition (Almand and Krohn 1978). Similarly, land use activities on the 2,300,031 acres of riparian wetlands on National Forest lands are exerting impacts that require prompt attention (Owen 1979). It is estimated that all land uses have eliminated 70 to 90 percent of all natural riparian ecosystems in the United States (Counc. Environ. Qual. 1978). We are fortunate that on rangelands a much higher proportion of the riparian habitats still exists.

Many authors have demonstrated that improperly managed grazing animals can alter riparian-stream habitats. A literature review by Gifford and Hawkins (1976) showed that no grazing system consistently or significantly increased plant and litter cover on watersheds. In an intensive review of this literature, Meehan and Platts (1978) and Platts (1981a) were unable to identify any widely used livestock grazing strategies that were completely capable of maintaining high levels of forage use while rehabilitating damaged streams and riparian zones. As this report will demonstrate, the remarks of Meehan and Platts no longer apply.

The high precipitation years of 1983 and 1984 resulted in flooding and high streamflows causing dramatic changes in many riparian-stream habitats in the West, according to Platts et al. (1985).

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These authors showed that three basin-range streams in improperly managed watersheds were degraded by these storms, but in those reaches where streamside vegetation was in good condition, flood impacts were minimal. Floods are part of the reason that many of the Nation's riparian-stream habitats are in their present condition, but probably more important are the small annual degrading effects that accumulate over time. A century of these small additive effects has resulted in major impacts on certain riparian-stream habitats. The Nation's riparian habitats are in dire need of better management. To initiate the needed rehabilitation, methods of better management must be constantly sought.

Improved Methods

The stream and its watershed function as a unit. Therefore, management must be applied on a basin approach. In addition, riparian habitats are much different from their adjacent drier sites and require site-specific types of management. Each grazing system, species of livestock, and type of land needs to be considered together. U.S. Forest Service research has begun to develop methods that are discussed below. But research must not stop here; it must move forward in developing better and more economical solutions to problems.

Riparian pasture

The riparian pasture concept is one strategy tested by the Forest Service that has excellent potential for bringing most allotments into successful management (Platts and Nelson 1985c). The riparian pasture is a smaller pasture within the allotment that encompasses the concerned riparian-stream area that will be managed independently to achieve the desired habitat responses. This pasture can also include the necessary amount of surrounding uplands to obtain a proper balance of riparian and upland forage. Advantages of the riparian pasture include better control over animal distribution, grazing intensity, and timing, as well as increased vegetation production, which in turn allows more management options for its use. Using the riparian pasture concept is expensive, and based on today's economy, may only be considered when valuable resources such as salmon and steelhead trout spawning and rearing areas need improved habitat management.

Stream corridor fencing

Platts and Rinne (1985) in an extensive literature review showed that riparian habitats benefited greatly after being fenced to eliminate heavy livestock grazing. Forest Service studies have documented rehabilitation results on Tabor Creek, Nevada; Big Creek, Utah; and Horton Creek, Idaho (Platts et al. 1983). In many areas, however, it is not economically feasible to fence every streamside corridor (Platts and Wagstaff 1984); therefore, successful grazing strategies that regulate animal distribution and forage use must be developed.

Specialized grazing strategies

The chief goal of a specialized grazing strategy (one that is more sophisticated than continuous grazing) is to maintain or improve livestock performance while improving or maintaining rangeland conditions by controlling the numbers, type, and distribution of livestock. Proper grazing of riparian vegetation requires controlled animal distribution. Conventional allotment management strategies, tailored to extensive areas, may not achieve acceptable animal distribution in the highly preferred riparian zones. Platts and Nelson (1985b) found that in 23 of 25 cases on study areas in Idaho, Utah, and Nevada, streamside vegetation use by cattle was twice as heavy as overall pasture use.

These studies showed that on conventionally managed allotments using rotation, rest-rotation, deferred, and season-long continuous cattle grazing strategies, cattle grazed riparian range types more heavily than the uplands.

Season-long continuous

Under season-long continuous grazing, livestock generally concentrate in riparian areas. Roath and Krueger (1982) reported that although the riparian zone constituted only 1.9 percent of the area of one allotment in Oregon's Blue Mountains,

it produced 81 percent of the vegetation removed by cattle. Eckert (1975) found on an allotment in northern Nevada that livestock obtained up to 88 percent of their diet on the wet meadow range site that occupied less than 1 percent of the allotment. Based on Forest Service studies that were in allotments using season-long continuous grazing (four study sites), it appears that this grazing strategy, under presently used intensities (60 to 95 percent), has little chance of success for improving riparian vegetation and fish habitats.

Winter grazing

Based on Otter Creek, Utah, study results we in the Forest Service believe that winter grazing has possibilities in the areas where winters are cold but snowfall is light (Platts and Nelson 1984). We could find few detrimental streamside effects and believe that the reasons were because streambanks were usually frozen and vegetation was dormant.

Rest rotation

Any grazing strategy that allows a period of rest for a riparian-stream habitat to rejuvenate has potential benefits. Success lies in providing the amount of rest needed to match the stream's capability to repair past damage and also to maintain a vigorous riparian habitat. The Forest Service could find no adverse riparian-stream impacts from a well-managed, double-rest-rotation (graze early then rest 2 years, then graze late and rest 2 years) grazing strategy on our study site on Johnson Creek, Idaho. Rest-rotation systems with controlled grazing intensity can be quite successful in riparian habitats (Platts and Nelson, in press). Rest-rotation grazing by sheep can be very successful (Platts 1981b).

Species of livestock

Different species of livestock graze watershed in different ways. Herded sheep usually use slopes and upland areas, while unherded cattle prefer the lesser slopes or bottomlands. Our two Forest Service study sites in Frenchman Creek, Idaho, have been in an allotment programmed for sheep grazing using a three-pasture, rest-rotation strategy since 1967 (Platts and Nelson 1984). After 8 years of study we found no significant changes in trends of any of the environmental factors measured. The stream and its riparian zone remained healthy and no significant changes were observed between the grazed and ungrazed pastures. Good management (proper herding, intensity, and timing) is undoubtedly the reason for the maintenance of the high-quality stream habitat. Herding allowed light forage use in streamside zones mainly after streambanks had dried out. This strategy could be useful throughout the Cascade, Rocky, and Sierra Nevada Mountains.

Riparian rehabilitation

The restoration and rehabilitation of degraded riparian areas should receive the highest priority for future research. The Forest Service has demonstrated at Big Creek, Utah, that riparian areas can be artificially rehabilitated, though better techniques need to be developed (Platts and Nelson 1985a). Conversely, in other areas (Chimney Creek, Nevada, and Bear Valley Creek, Idaho) we have had little success with artificial rehabilitation. Research leading to successful rehabilitation of riparian-stream environments is in its infancy.

Summary

Much of the water that falls on a watershed eventually must pass through the riparian area to reach the stream. Therefore, as the Nation's riparian habitats go, so go the Nation's streams. These riparian-stream habitats must be managed as separate entities, but always within a watershed perspective. In riparian management, it is time to stop looking at a small enclosure or a stream reach. Successful riparian management requires a basin or watershed approach. The Forest Service agrees with Behnke (1977), who has stated that rehabilitating riparian habitats is the most efficient way to increase salmonids in the western United States.

We also need to look far into the future. Our streams, especially in the West, were not ready

for the major storm events received in 1983 and 1984 (Platts et al. 1985). Because many riparian habitats were in poor shape going into this period, the additional degradation could add many years to their recovery. Some of the latest research indicates that even more drastic climatic changes may come in the future. Thus, future large storm events could put our streams under even more stress than they received during the 1983-1984 storms. Only healthy, well-managed riparian habitats will be able to withstand these conditions.

Most riparian habitats are extremely resilient (Platts and Nelson 1985b) and offer excellent opportunities for maintenance of good habitats as well as restoration and rehabilitation of degraded habitats. Livestock grazing under well-managed strategies can use riparian forage in compatibility with riparian-stream environments. We need to further develop and understand these compatible strategies and move toward their acceptance in rangeland management.

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PROCESSES OF RIPARIAN SYSTEMS: BACK TO BASICS

By Wayne Elmore[1]

Riparian areas are those areas of transition between the aquatic zone and the terrestrial zone that are influenced by surface and subsurface water; they reveal the influence of that water through the vegetation complex. They typically are the green areas along and around lakes, rivers, streams, springs, bogs, and wet meadows.

Although riparian areas comprise less than 1 percent of the land base in most western states, their condition is a major conservation issue. Many groups consider them to be both extremely productive and seriously degraded. Past management on federal lands typically has been the responsibility of wildlife professionals and improvements have been evaluated in relation to responses in wildlife habitat for fisheries, big game and nongame species. The most common management technique used for habitat improvement has been corridor-exclusion fencing, which has been difficult to maintain and is basically opposed by livestock growers and many public land managers.

However, riparian areas are much more than just wildlife habitat: they are systems that include several important processes. I am going to talk primarily about valley fill or alluvial riparian systems because the functions are easily observed.

The functions include--

1. Physical filtering of water: Riparian vegetation is designed to withstand high velocities of water and remain intact. One of its functions is to slow the flow of water, literally "combing" out sediments and debris. This water purification process also helps to build banks, so channels typically become narrower and deeper where once they were wide and shallow.

2. Hydro buffering: This process protects the banks from the hydrological process of water. Vegetation, such as grasses, sedges, and rushes lay down under high flows, literally forming a blanket over the banks. This process reduces bank cutting and aids in disposition of sediments.

3. Bank stability: The diversity of grasses, forbs, sedges, rushes, shrubs, and trees produce a variety of room forms to bind and hold in place the settled soils. This binding effect of the fibrous roots and tap roots helps repel the eroding force of high flows and allows the positive factors of bank building to progress.

4. Water storage: It is widely accepted that we can lower a water table and drain a stored underground aquifer through channelization or erosion. It is not accepted, however, that we can reverse that process and store water through natural recovery of riparian systems. Riparian systems slow the water flow and allow it to spread and soak into the banks, raising the water tables.

5. Recharge of underground aquifers: The aquifers in many areas of the West are going dry, and one of the processes of riparian systems is to help recharge a percentage of that aquifer. In degraded riparian systems, all the flows are contained in the channel because there are no banks or flood-plain areas where the water can spread. When banks rebuild through sediment filtering, they increase the area for water absorption, improving aquifer recharge by allowing gravity to work on the stored waters.

Other processes observed in central Oregon riparian systems that have recovered to a good condition class include increases in the base flow (minimum flow period), reduction in buildup of ice, and physical filtering of sediments by ice. We are presently studying these processes to better understand their role in the total cycle of the riparian system. We expect initial results to be available in 1 year and completion in 3 to 4 years.

Techniques used in the Bureau of Land Management (BLM), in Oregon and in other states, and by Bill Platts in Idaho prove there are many avenues to

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riparian management. We must not, however, omit the processes of the system and the potential of each individual site in determining our objectives. For example, Bear Creek, on BLM land in central Oregon, is managed under two different grazing treatments. One is high-intensity, short-duration, late wintering grazing and the other is early spring grazing.

Conditions influencing this stream include unstable soils, medium to high silt loads, and occasional high-intensity summer rainstorms. Both grazing treatments occur after the usual mid-February snow melt and before the main growing season in mid-May to mid-June. These treatments allow the processes of the riparian systems to function in the spring and for regrowth to occur for the summer storms and the following spring runoff. Both treatments have shown dramatic improvement in the riparian system. There are many other examples of innovative ideas, such as the use of the inexpensive Hydro Rams, which do not require power. Studies by John Heilmeyer, with BLM in Prineville, Oregon, show that Hydro Rams move water from streams to water troughs through a pipeline system at a cost of approximately $100.00. They can eliminate the need for construction and maintenance of water gaps in riparian pastures.

We have a good information base available, and now is the time to use it. The wildlife biologist, range conservationist, soil scientist, hydrologist, rancher, and conservationist must work together to manage riparian areas in a way that benefits all.

I frequently compare the position we now occupy in riparian management to the bird standing on one leg. It is difficult to go forward without both feet on the ground, we get nowhere in a one-legged position, and we fall on our behinds if we lift the other leg. It is time to move forward together with the collective knowledge we possess. My close friend Chris Maser often says, "No man has ever made a bad decision, because they are all made with the analysis of data and information available at that time." We now have new information and insights into the processes of riparian systems and the benefits they provide. Let us make a new decision.

In recognition of the importance of riparian systems and the direction we must travel, BLM is updating its policy for the management of these areas. The policy focuses attention and commitment to the management of riparian areas for all of their values over the long term. Management will be centered around the processes or functions outlined in this presentation. The importance of public participation, cooperation, and commitment will be emphasized. Participation by all interested parties, both public and private, is imperative for the successful management of riparian systems.

CONSERVING THE RANGE RESOURCE TODAY: SUMMARY

By Robert D. Swenson[1]

It was my pleasure to listen to this session on conserving range resources. The moderator was Charles Boothby, executive vice president of the National Association of Conservation Districts. The subtopics were as follows: "The Range Ecosystem--An Overview," by Dr. David Engle, range program leader, Oklahoma State University; "Offsite Impacts of Inadequate Range Conservation," by Dr. Edwin H. "Toby" Clark, senior associate, The Conservation Foundation; "Range Condition and Vegetation Management," by Harland E. Dietz, head, Ecological Sciences Staff, South National Technical Center, Soil Conservation Service; "Riparian Area Management," by Dr. William Platts, president, American Fisheries Society, and research fisheries biologist, Intermountain Forest and Range Experiment Station, U.S. Forest Service; and "Processes of Riparian Systems--Back to Basics," by Wayne Elmore, Oregon State riparian specialist, Pineville District Office, Bureau of Land Management.

Major Points

- One third of our rangeland is adequately treated. One-third could be treated with finesse in grazing management. The rest needs a strong, high level of attention.

- Managers and policymakers dealing with and using rangelands must always consider that (a) range systems are unique, and (b) range ecosystems differ among themselves.

- The area of rangelands is immense. Ownership is diverse.

- In addition to the primary range management concerns there are secondary and tertiary effects of deteriorated rangelands that are very costly.

- Plant condition rather than soil surface condition (soil loss) is the basic criterion to use to determine in a timely way what to do and how to set priorities for conservation of the range resource.

- Riparian areas are receiving attention as part of rangeland ecosystems. There are grazing systems that will provide livestock forage and improvement of riparian areas.

- Joint efforts are needed among owners, users, managers, advisors, and advocates to develop and carry out short- and long-range plans for positive results in range management.

The Range Ecosystem--An Overview

Dr. Engle focused on two major points for managers and policy makers: (1) Range ecosystems are unique and dynamic and (2) range ecosystems differ among themselves, especially as to levels of resources and their response and resiliency with use.

Other key points in Dr. Engle's discussion are:

- Range ecosystems are highly productive, particularly when you consider immensity.

- Range ecosystems are always dynamic and evolve in concert with all environmental factors seeking a natural equilibrium.

- Man has imposed himself as a factor in the ecosystem. His activity in suppressing fire, for example, has allowed certain fire-intolerant species to expand their range and density.

- Man has no choice but to become involved in the management of altered range ecosystems.

- Management of range ecosystems for whatever use is appropriately aimed at the ecosystem level rather than at a single component of the system. Managers will manage for the economic use or uses they are most interested in.

1/ State conservationist, Soil Conservation Service, U.S. Department of Agriculture, Huron, South Dakota.

- Inventories generally agree that rangelands are the major land type (about 50 percent) in the United States. If Alaska is included the estimates range from 800 million to 1 billion acres.

- Approximately two-thirds of the rangelands in the contiguous states are nonfederally owned. Of the remainder, about 25 percent are managed by the Bureau of Land Management and 7 percent are managed by the Forest Service.

- Grazable forage is the most economically important use of range ecosystems. Two Great Plains ecosystems, the prairie and the plains grasslands, contribute over 50 percent of the 195 million AUM's (animal-unit-months) of grazing in the 17 western states. Sagebrush ecosystems contribute just under 25 million AUM's. The remaining production is divided among several systems occurring nationwide.

In his descriptions of four ecosystems, Dr. Engle provides a basis for comparing stability and resilience, extent, uniqueness, and other characteristics. Of note, the Great Plains ecosystems recover rapidly from drought but may take a century to recover from the plow.

Offsite Impacts of Inadequate Range Conservation

Dr. Clark points out that while we are extremely concerned with the deterioration of rangelands themselves, we must also be aware of the substantial offsite damages.

These damages--I'll call them secondary and tertiary impacts, as compared to the primary impact on the rangeland ecosystem--are the results of sheet and rill erosion, gully erosion, wind erosion, streambank erosion, and critical habitat damage or destruction. According to recent estimates, sheet and rill erosion move abut 665 million tons of soil annually on federal and nonfederal rangeland in the 17 western states. Estimates available only for nonfederal rangeland in those states show that wind erosion moves about 609 million tons.

Five of the impacts (there are obviously many more) are:

- Damages to aquatic wildlife and the replacement of native species by other, lower valued species.

- Reduced populations of wildlife.

- Reductions in surface water storage capacity and groundwater recharge.

- Increased flood damage.

- Accelerated wear of equipment.

Recent estimates show that the economic impact of offsite damages can be substantial. The offsite costs of all erosion on rangeland in the 17 western states are estimated to be over $3 billion annually. Other studies have had similar or stronger results. The estimates probably are very conservative.

Range Condition and Vegetation Management

Mr. Dietz's key points are as follows:

- Early attempts to appraise rangelands resulted in the development of what is known today as the "range site and range condition" method of inventory. The system is widely used. Range condition is defined as the present state of the vegetation of a range site in relation to the climax plant community for that site. It is a comparison of present vegetation to what could and should be present.

- There have been efforts to determine resource management trends and even treatment needs by measuring erosion rates. This has been effective on cropland, but it cannot be considered an accurate, reliable, or timely measure of range degradation. By the time erosion becomes apparent on rangeland, serious depletion of the vegetation has already occurred. The first symptoms of range degradation occur in the plant community. Changes in surface condition of

rangeland soils occur much later. It is important that the most timely and reliable indicators be used. Thus we monitor the vegetation.

- A slow but persistent improvement trend is in progress on our rangelands. According to the 1982 NRI (National Resources Inventory) data on nonfederal rangelands, about one-third is adequately treated, one-third could be improved over time by finesse in grazing management, and the rest will need intensive treatment.

- The "conservation planning" technique used by conservation districts is a very effective way to get range conservation on the land. It provides ranchers and other decisionmakers with basic resource information on available technology. It can be used in a wide variety of ways.

- The National Conservation Program calls for efforts to improve range in poor and fair condition. There is an environment of shrinking funds for research and technical assistance. Addressing and setting priorities will influence long-term accomplishments in rangeland improvement. That influence may have very dramatic results.

Riparian Area Management

Dr. Platts' key points are:

- Information on rangeland improvement has shown positive results since the 1930's. It appears that the information is based mainly on upland range conditions. Riparian areas have been given little consideration.

- A 1978 report by the Council on Environmental Quality showed that up to 90 percent of stream ecosystems literally had been destroyed since the 1930's.

- There are no blanket solutions, but research demonstrates clearly that riparian areas will respond dramatically to improved grazing management.

- Research has demonstrated that livestock can graze riparian-stream habitats and not only maintain habitat conditions but also improve the habitats. With the improvements, these habitats could better "accommodate" future flood events and predicted climatic changes.

- Exclusion fencing should be considered unnecessary or at best a last resort.

- Applied over the grazing allotment, basin, and watershed, proper grazing systems will increase forage for livestock producers and at the same time improve quality of the Nation's streams for fisheries and a myriad of other uses.

Processes of Riparian Systems--Back to Basics

Mr. Elmore defines riparian areas as those areas of transition between the aquatic zone and the terrestrial zone that are influenced by surface and subsurface water, and, through the vegetation complex, reveal the influence of that water. Typically they are the green areas along and around lakes, rivers, streams, bogs, and wet meadows.

Elmore's key points are:

- Past management of riparian areas on federal lands typically has been the responsibility of wildlife professionals, and improvements have been evaluated in relation to responses in wildlife habitat for fisheries, big game, and nongame species. The most common management technique in the past has been corridor exclusion fencing.

- Riparian areas are much more than wildlife habitat. Important functions performed are physical filtering of water, hydro buffering, bank stabilization, water storing, recharging of underground aquifers, increasing base flow in streams, and others.

- There is a good information base available. It should be used at once. The wildlife biologist, range conservationist, soil scientist, hydrologist, conservationist, and rancher must work together to manage riparian areas in ways that benefit everyone.

CONFLICTS IN THE USE OF RANGE--CAN THEY BE RESOLVED?

MODERATOR'S REMARKS

By Rex Cleary[1]

I am going to set the stage for this panel by focusing on Cooperative Management--or Coordinated Planning--however you may prefer to call it.

In April of 1984 there was a symposium in Arizona. The title was "Cooperative Approaches to Resource Management on Public lands." It was sponsored by the Bureau of Land Management, the U.S. Forest Service, and the University of Arizona.

The proceedings of that symposium demonstrate that a lot of cooperation is happening in Arizona--a forward looking, healthy atmosphere. The summarizer for our panel today is Frank Gregg, director of the School of Renewable Natural Resources, University of Arizona. I view that as a helpful linkage because I see the opportunity for this panel to pick up, in part, where the Arizona symposium left off.

Frank made both the introductory and concluding remarks for the Arizona symposium. In his concluding remarks, he made some pertinent points! He noted the possibility of expanding the Arizona symposium into a national event. He observed that if the consensus about fundamental principles of decentralized, cooperative decisionmaking involving all affected interests within a broad policy framework is felt at this moment of history to be right for Arizona, a lot of other people around the country may be sensing the same needs. The subject of this panel--Can Conflicts in the Use of Range Be Resolved?--is clearly central to that observation.

Frank also noted the possibility of cutting short the time needed to make cooperative management a fairly conscious style of public land management suitable for wide application.

1/Director, Society for Range Management, and district manager, Bureau of Land Management, U.S. Department of the Interior, Susanville, California.

And he made another point I want to build on. He stated:

> "I sense we want to go slow on moving toward cooperative management approaches as a preferred approach in public land management, but we want to go. We want to stay loose; we don't want to codify around the experiments in Stewardship. We would like to have a generally supportive policy environment from all of the effective agencies, but we're nervous about structure. I invited you to comment about structure and nobody did. I take that as mortal fear of 'bureaucratizing' a system that is still evolving."

That statement has a loud ring! And I agree.

I have been directly involved in Experimental Stewardship as co-manager of the Modoc/Washoe Program in California and Nevada. We who have been participating have shared this concern for some time. We have struggled with how to avoid "bureaucratization," but at the same time contribute meaningfully to a broad movement toward cooperative management.

For some time we have labored over the competition between the "Experimental Stewardship Program" (ESP) and "Coordinated Resource Management Planning" (CRMP).

The authority for ESP is in law--the Public Rangeland Improvement Act. The authority for CRMP is in a National Memorandum of Understanding (MOU) between four agencies--Soil Conservation Service (SCS), Forest Service, Bureau of Land Management, and the Science and Education Administration.

The two programs have quite similar missions and purposes--namely Cooperative Resource Management. Since the missions are so similar, we view the competition as largely between labels.

Nevertheless, the competition has been doing a disservice to both programs. More important, it has been doing a disservice to the concept of cooperative management in general. And back to Frank's point, the associated defensiveness has increased the risk of "bureaucratization."

There are clearly enough substantive issues to debate in the range community. We don't need this cosmetic label issue to waste energy on. We need to lay it to rest quickly and get on with cooperative management.

Therefore, we in the Modoc/Washoe ESP Program have advanced a proposal to marry ESP and CRMP. Specifically, the proposal is:

1. Use CRMP for future cooperative management efforts where some degree of structure would be useful.

2. Initiate no new ESP's.

3. Continue experimentation in existing ESP's.

4. Use the existing ESP's to continue developing skills, methods, and techniques to refine and improve the effectiveness of CRMP.

5. Revise the national interagency CRMP MOU to strengthen it to take advantage of the marriage with ESP.

Putting the emphasis on CRMP has some advantages:

- o It is already institutionalized with a national interagency MOU.

- o It is a vehicle currently available to all managers and communities.

- o It can readily be applied to exclusively private land areas. Example after example already exists where CRMP programs have been developed without any public land involved.

Arrowhead Lake in California is an example without public land. Some of the issues there are water quality, housing development, recreation, and fire control. Participants include the local community members, state and local agencies, and SCS.

By the way, I listened with interest to Dayton Hyde's presentation yesterday on conflicts. I could not help but wonder if a cooperative management vehicle of some such nature might be helpful to Dayton. The variety of festering wildlife and water issues that he told us about on his Yamsee Ranch could possibly find resolution in such a cooperative management approach. It could also give Dayton public visibility to help sell his ideas.

Advocacy of any particular program structure for broad application should be discouraged. Rather the concept should be something like developing an assortment of case studies to draw on. A "how to" handbook. Somewhere to turn for help.

When a community feels the need for help in cooperative management, they could turn to this pool of examples to pick and choose ideas for structure, methods, and techniques. It has to be this way because a vital key to cooperative management success is local design to meet local needs and local circumstances.

Organizational structure, if needed, can range from slight to highly structured. For example, some situations may benefit from committees and subcommittees. Others may not.

As Frank put it, the important thing is to shift to a fairly conscious style of cooperative management suitable for wide application--and local design is critical to wide application.

Frank mentioned something else--that the classic training programs for professional people in the natural resources fields are very skimpy on the kinds of skills they were talking about. That's so true. The school of hard knocks is most frequently relied on.

The kinds of skills we are talking about that are in short supply are largely behavioral, social, and political. One small example is that in the Modoc/Washoe Program we have all learned to express ourselves in terms of our needs, rather than a position. A discussion on needs has a magic way of generating ideas for alternative ways to satisfy the needs, and it ultimately leads to solutions. On the other hand, a position statement leads to confrontation.

For instance, let us say a biologist states a

position that grazing must be excluded from a prime riparian area. The rancher response might be "shove it." On the other hand, the biologist can explain he has a need to increase the density of the riparian vegetation and leave some residual cover for sage grouse.

Once the need is understood, there is usually a spontaneous flow of ideas from the group on how to satisfy the need by altering grazing practices rather than excluding grazing. And you are on your way to a solution.

It takes skill to change this behavior in a group. But the skill can be acquired.

The same pool of examples and knowledge I talked about to draw on for ideas on structure, methods, and techniques could furnish ideas on skills.

In developing this ESP/CRMP marriage proposal, our Modoc/Washoe Steering Committee brought in Maurice Bidart to share ideas. Maurice is a National Association of Conservation Districts (NACD) director from Nevada.

Maurice took the marriage idea to the NACD board of directors meeting in Vale, Oregon, 2 weeks ago. Charles Boothby tells me the board took favorable action to work toward accomplishing the proposal.

I am also looking forward to discussing the marriage idea with my colleagues on the Society for Range Management board of directors at Orlando in February.

I chose to focus on cooperative management to set the stage for this panel, because I view cooperative management as central to resolving today's conflicts in the use of the range. And the emerging demands and new products we will hear about become tomorrow's conflicts.

The alternative is litigation and legislation.

Let us hear from our distinguished panel members.

RESOLVING CONFLICTS ON THE USES OF RANGE THROUGH MEDIATED NEGOTIATIONS: ANSWERS TO THE TEN MOST ASKED QUESTIONS

By Gerald W. Cormick[1]

The use of mediated negotiations to settle public policy and public management controversies has received increased attention in recent years. In part, this growing interest results from a realization that existing means of reconciling competing claims for the use and preservation of resources are time consuming, focus on procedural issues rather than the underlying concerns of competing interests, and ultimately result in compromises being made by those unfamiliar with the realities of resource management.

The past decade has also seen a growing body of experience in the use of mediated negotiations in such disputes. During 1973 and 1974 a colleague and I first employed "environmental mediation" to settle a decade-long controversy involving flood control, protection of a free-flowing river, and the threatened development of agricultural lands. Since that time we and others have successfully mediated a wide variety of disputes. The issues have ranged from the management of public lands to the management and development of fisheries and from the exploration and development of offshore oil resources to the siting of unpopular public facilities. The parties or interests who have reached agreement have included representatives of public agencies at both the policy and management levels, elected officials, tribal governments, private corporations, national advocacy groups, farmers and agricultural interests, and citizen organizations formed in opposition to particular policies or projects. In sum, they illustrate the broad applicability of mediated negotiations.

There is now sufficient experience in the mediation of natural resource based disputes and in the implementation of agreements reached to provide clear guidance in how, when, where, and why to use the process. This paper will draw on this growing body of experience to answer the ten most frequently asked questions regarding the use of mediation to resolve public policy and public management disputes.

1. What Is Mediation?

Not unexpectedly, "What is mediation?" is usually the first question that I encounter. Less expectedly, there is a good deal of confusion over the definition of the process. I feel strongly that those who would consider participating in a process to settle disputes over issues that could be of critical importance to the future of a public resource, their own economic future, and/or their enjoyment of recreational and other values must have a clear understanding of the process they are considering, where it is appropriate, and how it works.

In defining "mediation" it is first necessary to understand "negotiation." Simply stated, "mediation" is negotiation with the assistance of an independent intervenor or "third party." Negotiation is a familiar tool. It is the "art of the possible," a mutual recognition that there are limits on unilateral action and that there may be solutions more advantageous than continued conflict. Negotiations occur when two or more conflicting or competing interests meet in a conscious attempt to find some solution to their differences to which they will mutually commit themselves to support and implement. A concommitant understanding should be that, should they fail to reach such an agreement within some specified time frame, each is free to pursue its interests as it sees fit, whether through unilateral decisionmaking, the courts, or other means.

The mediator assists the parties in their efforts to find agreement. The term "mediator" describes a relationship between the intervenor and the disputing interests, not a set of skills. That relationship has four critical attributes: (1) the mediator is independent of the parties; (2) the mediator serves at the mutual pleasure of the parties; (3) the mediator's attention is focused on the process of dispute settlement, not the substance of the dispute; and (4) the responsibility of the mediator is to help the parties

1/ President, The Mediation Institute, Seattle, Washington.

find a mutually acceptable settlement through joint efforts.

2. What Does A Mediator Do?

In natural resource conflicts, the mediator is likely to perform three major tasks: (1) acting as a convenor in assisting the parties to define the terms and conditions under which they will negotiate; (2) acting as a broker, representing the interests, concerns, and ideas of the parties to one another, often outside of joint sessions; and (3) acting as a facilitator in joint sessions.

For each of these tasks, the mediator will employ a variety of skills. Many of these skills are employed by any effective manager or professional, including the ability to listen and hear the parties' underlying concerns, helping to ensure that the problem is fully explored and understood before focusing on a particular alternative and clarifying the information and intent communicated between the interests. However, because the mediator is not on anyone's "side," has no direct influence over the parties, and will not be on the scene in the future, he or she can use some special skills and provide services not otherwise available in conflict situations. These include representing the perspectives and concerns of each interest to every other interest, interpreting intent and inference, acting as a "agent of reality," and being a collector and keeper of confidences in the search for areas of mutual interest and/or accommodation. the mediator's most frequent phrase is "What if...?" as he explores possible tradeoffs between the parties. At times, the mediator will provide an excuse for the negotiator to explore areas of accommodation within his or her own organization. The mediator may also take care of such procedural details as arranging and scheduling meetings and agendas, facilitating (not chairing) a negotiating session, and helping to draft positions and settlements.

There is often confusion, even among those who offer dispute settlement services, regarding the differences between the role or relationship to the parties of the mediator or other intervenor and the specific tasks they perform or skills they use. For example, one can be a facilitator or even a broker while in the employ of one of the parties to a dispute. Many "public participation" practitioners are very good at convening joint meetings but because they are the agents of--are paid by--one of the affected interests they cannot function as mediators. It is important to understand these differences in order to evaluate the performance of the intervenor and to assess what they (and the process they espouse) can reasonably be expected to achieve.

Mediation is often confused with other processes. Mediation is not arbitration, a judicial process where a third party listens to the positions and arguments of the disputing interests and makes a decision. Nor is it fact finding, where the third party listens to presentations by the disputing parties and makes a public recommendation for disposition of the issues. Mediation is not public participation, where competing interests are merely invited to provide information to a decisionmaker. Nor are mediated negotiations merely an exercise in polite social discourse--or intercourse--as a result of which it is hoped the parties will learn to understand and trust one another. Mediated negotiation is a means of jointly dealing with the realities of conflicting values and competition over finite resources in an effort to find some solution that all affected interests can live with and live by.

3. Where Has Mediation Been Successfully Used?

The use of mediated negotiations is no longer just an interesting idea. It is a process which The Mediation Institute and others have demonstrated can result in settlement of even the most bitter and protracted disputes. The following are examples of situations where Institute mediators successfully assisted disputing interests in finding mutually acceptable solutions that have proven technically, economically, and politically feasible:

- In Washington State, a county government and an environmental organization sought the assistance of a mediator in a successful effort to settle a dispute over the use of herbicides in vegetation control on public road rights-of-way.

- In Washington, D.C., the Occupational Safety and Health Administration (OSHA) asked the Institute to initiate discussions with those involved in the long-standing controversy over the appropriate national standard governing occupational exposure to benzene. Those participating in the discussions were industry and union representatives from the oil, steel, chemical, and rubber sectors of the economy. Although no consensus was reached on a standard to propose to OSHA, all parties agreed that the discussions brought them substantially closer together. In fact, the Rubber Manufacturers Association and the United Rubber Workers did forward a letter to OSHA containing their joint recommendations on issues specific to their industry.

- In California, a series of agreements have been reached in negotiations between oil companies and commercial fishermen over conflicts related to offshore oil development from the Santa Barbara Channel to Morro Bay. The agreements reached have included the creation of a jointly operated liaison office, agreed-upon permitting requests to state agencies, and jointly designed and managed research projects.

- In Colorado, a group representing 20 different economic, wildlife, conservation, and other interests were able to reach a unanimous set of recommendations concerning the use and management of sensitive areas in the San Juan National Forest. The consensus recommendations were adopted by the Forest Supervisor.

- Also in Colorado, the Homestake Corporation and a number of environmental and other citizen organizations reached an agreement which settled their differences over the operation and reclamation of a uranium pit mine in the Gunnison National Forest. State and federal agencies concurred with the agreement.

- In Maryland, two professional organizations, The Society of American Foresters and the Renewable Natural Resources Foundation, reached agreement in a dispute over their financial relationship and future management and development of a shared estate.

- In Oregon, two towns, a county, a port authority, four state agencies, and four federal agencies reached a mutually acceptable plan for the nature and timing of development in the Columbia River estuary. The controversy had pitted development interests against conservation interests and threatened the viability of Oregon's land use planning process.

- In Massachusetts a dispute was settled when federal and state agencies, local interests, and a conservation organization jointly signed a motion for dismissal of an action that had been filed to stop construction of a major soil conservation and flood control project. The motion for dismissal, accepted by the U.S. District Court, stipulated that project construction could proceed and provision would be made for the municipalities involved to compensate the state for park and forest lands taken for this and future projects.

4. Why Should I Use Mediation?

The best reason to consider mediation is that it can result in better decisions. Sometimes "better" can mean simply that a decision is made and implemented where the inability to reconcile differences was resulting in escalating costs to all involved and deterioration of a resource base. In other situations, through joint agreement parties have found it possible to implement innovative approaches to resource management and allocation that were not available under existing policy and even legislative guidelines. Other agreements have resulted in disputing interests undertaking and committing to joint research efforts, rather than continuing to use scientific and technical experts as cannon fodder in continuing procedural battles.

Successful mediation also leads to solutions and decisions that can be implemented. Too often, "decisions" made by resource managers are merely a

step in a process that leads through administrative procedures to the courts and legislative battles. The primary protagonists become those adept in these procedures and arenas, such as attorneys and lobbyists, rather than those experienced in the management of and primarily concerned with the future of the resource. Mediation, therefore, not only brings closure through joint commitments but also enables those best equipped to understand the problem to find the solutions.

Mediation will lead to accommodation and even compromise. However, any tradeoffs will be addressed by those most conversant with their impact. Too often, compromises are made in the tradition of Solomon's famous threat to "cut the baby in half." It is far better for those directly concerned to sit down and reach an agreement on the nature of the problem and criteria for its solution than to gamble on some unknown arbiter's imposition of a compromise solution.

Perhaps the most important advantage of mediation is its ability to focus on the real concerns and issues that divide the disputes. Most administrative and court challenges are fought on procedural issues. Even when an organization, for example, wins a challenge to an environmental impact statement (EIS), all it "wins" is a new EIS. The nature of public hearings and the EIS process lead to a focus on technical concerns and formal positions, making it difficult to focus on and explore the more social "What does it do to me and what I believe in?" issues.

Mediation can result in quicker resolution of disputes and, for most of us, "time is money." However, it must be recognized that there are situations where delay per se is the legitimate strategy of one of the interests and in such situations mediation is not appropriate.

It is often claimed that mediation is less expensive than other dispute settlement mechanisms, such as the courts. This may be only partially true. It may, for example, be less expensive for a citizen coalition to retain the services of an attorney to draft the briefs to pursue a court challenge than it is to engage the services of the kinds of experts necessary to enable them to participate as informed partners in the decisionmaking process. In government agencies the resources to fight a legal battle are unlikely to be met from a particular department's or division's own budget allocation. However, the resources to negotiate will probably have to be found within existing budget constraints.

Realistically, you or I will seldom use mediated negotiations if we have the capacity to act unilaterally: It is quicker and easier to do it ourselves and we really know what is "best". However, few of us really have the ability to act unilaterally in situations involving the management of public resources or the making of public policy. Under our system of government we have chosen to place a great deal of power in the hands of the individual citizen. Mediation is in the tradition of "government of the people, by the people, and for the people".

5. What Are The Risks in Using Mediation?

The use of mediation is not without risk. However, the nature of the process makes it possible to minimize the risks by exploring and beginning the process a step at a time and ensuring that all parties are and remain committed to the effort.

The first step must be to ensure that you have the support to pursue a negotiated solution within your own organization or constituency. To fail to do this can result in accusations from within that you have "sold out", suspicions as to whose side you are on, a lack of commitment by those you represent to support solutions that are reached and, most serious of all, an inability to "ratify" commitments you have made.

A second risk is that one or more parties will enter into "sham negotiations" using the process to delay rather than make decisions. This risk can be minimized by explicit agreement on deadlines for making progress on issues and reaching agreements.

A third risk is that the process may actually increase misunderstandings and distrust. This will occur where the parties rush to address the issues before first considering and agreeing on the framework for the mediated negotiations. We have seen situations where matters as basic as whether or not agreements will be in writing, the scope of issues to be considered, and even whether "agreement" means a consensus of groups or of every individual involved have not been addressed. conflicting assumptions as to the disposition of such matters can lead to charges of bad faith and deception by intent, not only preventing agreement on the issues in dispute but reinforcing the worst expectations and stereotypes of the parties.

These and other risks can be minimized by using a mediator to convene a mediated negotiation effort, assisting in the exploration of whether or not mediation is appropriate and developing an initial agreement on the terms and conditions under which the process will proceed. Remember that an inability to agree on terms for the mediated negotiations is an early indication that the parties will be even less able to agree on the issues which divide them, and the effort can be aborted before negative consequences emerge.

6. How Do I Know When to Use Mediation?

The most important means of avoiding the possible risks of the mediation process is a clear understanding of when it is and is not appropriate. Mediated negotiations are <u>not</u> appropriate in all situations nor at every point in the development of a dispute. Some disputes may involve issues of such important principle that for some parties defeat is preferable to compromise. In others, one or another of the parties may be concerned with creating a precedent. Often, one party is concerned with settling the issues while others would prefer the conflict continue and still other potential parties aren't even aware that the conflict exists. The Mediation Institute encourages those pondering the use of mediation in a particular situation to consider the following questions:

- Are you and your organization willing to consider a compromise?
- Do you have room for flexibility?
- Why do you want to end the dispute?
- Has the conflict reached the point where the issues have been defined and joined and you know who the parties at interest are?
- Do all parties have some reason to bargain? Does each have the ability to frustrate or make prohibitively costly the unilateral actions of the other(s)?
- Is the outcome uncertain?
- Is there some sense of urgency to settle the conflict?
- Do you have the support of your organization to explore possible mediation? Do they understand the implications of such an effort
- How would the other interests respond to the same questions?

7. Are There Rules and Procedures for Mediation?

Beyond the essential factors which define mediated negotiations, discussed above, the establishment of rules and procedures provides an important opportunity for the parties and the mediator to develop a framework which best meets their unique circumstance. It is also an opportunity to test out the ability of the parties and mediator to work together. As I have already noted, if you are unable to agree on the "rules of the game," you are unlikely to agree on the issues. There is also something to be said for having reached some understandings and having made some mutual investment in the process as a positive basis for moving forward to more divisive topics. Again, based on our experience, Institute mediators suggest that the parties to a proposed mediation effort consider at least the following matters in establishing a framework for negotiations:

- Are all parties who have a stake in the outcome and the ability to affect implementation involved and/or supportive of the effort?

- Is there general agreement on the scope of the issues to be addressed?
- Are representatives authorized to speak for their constituents?
- Has there been an explicit commitment to make a "good-faith" effort to reach and implement an agreement?
- Are there reasonable assurances that affected government agencies will cooperate in implementing an agreement?
- Are there established deadlines for completing, discontinuing, and/or evaluating the progress of the mediation?
- Are there clear understandings as to the role of the mediator and negotiators in dealing with interests not at the table?
- Are the meetings to be "open" or "closed"? Will there be observers?
- Who will deal with the media? How?
- Are the parties agreed on the form and nature of any agreement that will be reached (written? signed? contract? recommendations? to whom?)?
- Do the parties understand that there will be no votes or minority/majority reports?
- Is it understood that agreements must be formally ratified or approved? Is there a process for doing this?
- Are there understandings on the use of information and positions developed and divulged in negotiations, whether or not the parties are successful in reaching a final settlement?
- Have you reached explicit agreement on these matters?

While they are not "rules", there are also a number of approaches and tactics that will assist the parties to mediated negotiations in attaining their mutual (and separate) objectives. In the process of helping disputing parties to find some resolution of their differences, Institute mediators often find themselves offering the following counsel:

- Don't "strip and go naked." Build confidences and share information carefully and on the basis of demonstrated willingness to deal in good faith.
- Remember that while information is a form of power, your opponents have to know what you need in order to make useful offers.
- Continually test your assumptions about what the other parties want and what their priorities are.
- Deal in packages. Remind one another that all offers and agreements are tentative until such time as all of the issues are settled.
- Make sure that you and the other parties are regularly checking with your clients and constituents as information is developed and positions are altered.
- Use the mediator to try out ideas. That way if a concession is rejected, you haven't offered it.
- The more secure--the "safer"--your opponents feel, the more likely they will alter their positions and consider innovative alternatives.
- Be prepared for joint meetings. Review what is likely to occur. Make sure the mediator has established an agenda.
- Recognize that if you need a mediator and are using him or her effectively, you are probably spending more time in separate meetings and caucuses with the mediator, than in joint sessions.

- o Remember that if you don't trust the mediator or he or she isn't being helpful, it is the prerogative of any party to dispense with their services.

It is possible to enter into negotiations with the best intent. The situation can be appropriate. But, without a procedural framework for negotiations and a mutual understanding of the "rules of the game," the effort will fail.

8. Who Are Mediators And Where Do You Find Them?

In our definition of "mediation" we also explored the role of the "mediator"" (1) the mediator is independent, serves at the mutual pleasure of the parties, and focuses on process rather than substance, helping disputing interests find a mutually acceptable settlement through their joint effort. From this it follows that the most important attributes of the mediator are his or her independence from the disputing parties and acceptability to all involved, and demonstrated experience in the settlement of difficult and complex issues.

Contrary to what many may first assume, it is important that the mediator not be perceived as technically expert in the matters that form the substance of the dispute. There are a number of reasons for this. First, "experts" have a tendency to rely on their own assumptions and values. Second, they may filter information and communication based on their own assessment of the "facts." Third, there is the danger that discussions will tend to focus on the technical matters, ignoring the basic value issues and resulting in solutions that, while technically sound, do not represent an accommodation of the real differences which separate the parties. Fourth, to the extent the mediator "leads" the parties to an agreement that he or she believes is appropriate, the parties will have a decreased sense of ownership and commitment, making implementation difficult. Fifth, expertise can lead to arrogance, with the mediator operating under the delusion that he or she really knows what is "best" for the parties and for the public at large. Finally, there is a presently unresolved question as to whether in situations where the mediator is expert and, therefore, a direct contributor to the substance of a public management or public policy decision, he or she should be discoverable in subsequent legal or administrative proceedings. If this is the case, all claims or assumptions of confidentiality are moot.

However, the mediator must be a quick study and has a responsibility to become sufficiently knowledgeable about the issues and the legal, legislative, and organizational environment withi which they occur to communicate effectively and assist the parties in devising solutions that are technically, economically, and politically viable

It should be possible for you to "check-out" a mediator or mediation organization with those who have responsibilities and perspectives similar to your own and who have used their services. This a far more important credential than any diploma or certificate earned as a result of a course of study or attendance at a workshop. An experience mediator will be able to provide you with references that can help you assess their abilities and appropriateness in your situation.

Mediation is an inherently personal and social service and process. Some individuals or parties may not feel comfortable with a particular mediator whatever his or her experience and qualifications. Settling disputes is a difficult business and if you have reservations about the mediator for whatever reason, don't saddle the process, yourself, or the other parties with this additional burden. Don't use a mediator you can' trust or feel generally comfortable with.

Similarly, the best way to find a mediator should be through those who have used such services. Ge the suggestions of your colleagues who have used mediator. In addition, there are also a number o organizations such as The Mediation Institute and The Conservation Foundation who are sources for mediators or can direct you to other sources.

9. Who Pays For Mediation?

The question of who will pay for the services of mediator is a difficult but important one.

Historically, mediation has seldom been paid for by the parties to a dispute. In labor-management negotiations, for example, virtually all mediation is supplied by independent government agencies at no cost to the parties. The service is offered because it was determined that settling labor conflicts was good public policy. For the first decade of our experience in what has been called "environmental mediation," most mediators were available to disputing parties either without cost or at a highly subsidized rate as a result of the support of private foundations for the process. Unfortunately, as such efforts have proved their worth, foundations have moved on to other innovative programs.

A basic dilemma is the perception (and, often the reality) that "he who pays the piper calls the tune." It is necessary, therefore, to find some means of supporting the cost of the effort that is mutually acceptable to all parties. Several realities make this difficult. First there are often so many interests involved in a public policy or public management dispute that you need a mediator just to get the parties to address one another, never mind the question of sharing cost. Second, there is frequently a major disparity in the financial ability of the parties. Third, where parties are locked into a major confrontation a good deal of effort will be required to help them assess whether or not to consider mediated negotiations before they can take such a publicly affirmative action as agreeing to share in the cost of the effort.

Most mediators and mediation organizations will be willing to invest a limited amount of time and resources in an initial exploration with the parties of whether or not mediation is appropriate. In other situations, public agencies have found that it is possible to meet the expenses of this exploration and even of convening a negotiation effort where they are willing to make certain assurances. For example, other involved interests should be assured from the outset that their participation is voluntary, that the process will not proceed without the involvement of all major interests, and that all interests have the right to participate in the selection of the mediator (or in rejecting the continued involvement of the convenor as a mediator).

As a part of its own efforts to deal with the dilemma created by the unequal ability of disputing organizations to meet the cost of mediation services, The Mediation Institute has established a Fund for Mediation Services. This newly established fund can provide the resources to enable less financially able parties to pay their share of the mediation cost--and "own" their share of the mediator. Where such funds are made available, all interests to a mediation effort are asked to make a commitment to seek some means of replenishing the Fund for Mediation Services at the conclusion of their dispute so that similar support will be available for others. Information regarding the fund is available from The Mediation Institute.

The most important requirement in determining who will pay for mediation services is that all of the parties, both representatives and constituents, explicitly agree on the terms and conditions for supporting the process.

10. What Should I Do If I Want To Try Mediation?

The most exciting aspect of mediated negotiations is that the process is available to you right now. It can and has been used under existing laws, regulations, and traditions. There are examples of where and how it has been successfully used in situations similar to most of those you encounter.

If you are considering the process, I would recommend that you begin by reviewing the issues raised in this paper. You might also wish to consider reading case studies of successful efforts and the writings of other practitioners. Then, find someone to talk to informally and confidentially about the process and your situation. This may be someone who is in a position or involved in disputes similar to those with which you are concerned or you may wish to talk with an experienced mediator. The Mediation Institute reserves a substantial portion of its time and resources for this type of informal, confidential discussion with parties to disputes.

WHAT ARE THE CONFLICTING DEMANDS ON RANGE TODAY?

By William A. Molini[1]

Rangeland ecosystems provide an array of values. The primary values traditionally have been livestock forage, minerals, oil and gas, watershed, recreation, and wildlife habitat. Increasing in value are geothermal resources; fuel wood; wild horses and burros; air quality; soil; and scientific, educational, scenic, geologic, and archeologic sites.

Although quantifying the various demands on range is difficult, clearly we can say that the most significant demands--and the demands most often in conflict--are livestock grazing, mining (oil, gas, and geothermal), watershed, and recreation (consumptive and nonconsumptive uses of wildlife).

There is a major difference in the motivations for these demands. Lifestock grazing and mining generally are private sector, profit-oriented uses. Wildlife habitat, watershed, and many recreation uses are public trust uses, especially on public rangelands.

In this paper I will focus on what I consider to be the major conflict--that between traditional livestock grazing and the new demands for maintenance or enhancement of watersheds and wildlife habitat. At the heart of the conflict is the ecological condition of the rangeland.

Watershed

Watershed for both underground and aboveground water sources might well be the foremost societal value of rangelands today. In the arid, range-dominated states of the West and Southwest--particularly Arizona and Nevada--the demand for watershed protection and enhancement certainly is increasing because of human population growth.

Watershed productivity is closely, if not exactly, correlated with overall ecological condition of the range. Soil depth and porosity, for example, are influenced by the density and composition of the plant cover. Productive, healthy rangelands are the best watersheds.

Wildlife Habitat

Wildlife abundance and diversity are also functions of habitat quantity and quality--the mix and juxtaposition of water, food, cover, and space. Productive ranges with a diversity of vegetation and with available water are productive wildlife habitats.

There is then a strong relationship between watershed and wildlife habitat and although there are certainly some divergences in terms of maximization of a single wildlife species and maximization of watershed values, generally actions which maintain or enhance the productivity of one will enhance the other.

Wildlife in its myriad forms is one of the most valuable of range resources. Wildlife is the focal point of many of the recreational demands on range, including the traditional consumptive uses of hunting, fishing, and trapping, and the nonconsumptive uses of photography, wildlife observation, and amenity value. Wildlife also plays a key role in the scientific and educational values of range and further serves as a key indicator of overall environmental health and a barometer of range condition and trend.

In the last 5 years, managers have accelerated efforts to demonstrate the economic values of rangeland wildlife. The Nevada Department of Wildlife, for example, has gathered data on hunting trip expenditures as one measure of wildlife economic value (Kay 1985). These data on the cost per hunt and per "hunter day" were provided by a questionnaire distributed to holders of big-game tags. While there still is some variability in the data base as to the usefulness of the hunter day in determining wildlife economic value, we should consider the surprising findings of the Nevada study.

1/ Director, Nevada Department of Wildlife.

During the 1984 season for Desert bighorn sheep in Nevada, 102 respondents to the Department of Wildife questionnaire reported spending an average of $2,379 for their hunt with a range of $215.00 to $9,282.00 and a total expenditure of $232,223.00. The average expenditure per hunter day was $187.32 during the 1985 season in Nevada; 44 elk hunters reported an average expenditure of $699.32 each, or $116.55 per hunter day, while 428 antelope hunters spent an average of $502.52 each, or $83.75 per hunter day. These figures were higher than the $23.10 expenditure per big-game hunter day used by the U.S. Forest Service (1982) and a $56.71 expenditure per big-game hunter day used by the U.S. Fish and Wildlife Service (U.S. Dep. Inter. 1982).

If Nevada, a predominately rangeland state, reflects the demand situation for rangeland wildlife, some inferences about the economic value of rangeland wildlife can be made. The expressed demand for hunting certain big game species in Nevada has been recorded for over 30 years. The highest expressed demand for bighorn sheep hunting occurred in 1985 (Nevada Department of Wildlife records), when 2,950 resident and nonresident hunters applied for 132 available tags for a demand/supply ratio of 22.3/1. The highest expressed demand for antelope hunting also occurred in 1985, when 4,072 resident and nonresident applicants applied for 691 available tags for a demand/supply ratio of 5.9/1. Likewise the highest recorded elk expressed demand occurred in 1985, when 3,378 resident applicants applied for 95 available elk tags for a demand/supply ratio of 35.5/1.

Clearly then, in Nevada, as in most western range states, the demand for big game hunting, which is only one segment of the wildlife resource, exceeds the supply. This situation is further illustrated by mule deer, which provide by far the greatest big game hunting opportunity in Nevada. The greatest expressed demand for hunting this species occurred in 1970 when an unlimited number of tags were available. In that year 47,100 tags were sold and the total demand, at least in terms of hunting opportunity, was met. As demand, in numbers and composition of deer harvested, began to outstrip supply, a quota system was implemented.

The Nevada Department of Wildlife has calculated maximum demand of 57,000 hunters for mule deer i 1985, if the hunters were not encumbered by havi to apply for tags (Nev. State Board Wildl. Comm., 1984). The expressed demand in 1985 was 45,554 resident and nonresident applicants for 34,877 tags.

Applying the Nevada Department of Wildlife's dat on average expenditures the estimate is that hunters of bighorn sheep, elk, and antelope will spend a total of about $728,000 in 1985. If tot expressed demand could have been accommodated in 1985, hunters would have spent $7,018,050 for bighorn sheep, $2,048,216 for antelope, and $2,361,222 for elk, for a total of $11,472,488. Deer hunters in 1984 spent $5,635,000, based on the U.S. Fish and Wildlife Service's 1982 estima of $56.71 per big game hunter day and an average of 4.3 days per hunter. If the maximum estimate demand of 57,000 hunters of deer could have been accommodated in 1985, those hunters would have spent nearly $14 million. In total then, expenditures for big game hunting in Nevada also would have amounted to about $25 million for 198 if expressed demand could have been accommodated

The annual expenditures for hunting and fishing Nevada have been estimated at about $146 million (Nevada State Board of Wild. Comm., 1984) not including trapping and nonconsumptive use of wildlife. If the full demand could be met as displayed for select big game species, this figu would be considerable higher.

One other factor should be considered in the wildlife economic value equation, and that is th cost to produce wildlife on ranges. While definitive work on this subject remains to be done, the following analysis--obviously not a precise expression of the cost/benefit ratio--provides some insight on this subject. T fiscal year 1985 budget for the Nevada departmen of Wildlife is 7.3 million dollars. This budget represents the cost to operate a comprehensive wildlife management program, but does not includ any major costs of habitat maintenance and improvements (except for state-owned wildlife management areas), which are largely borne by th federal land management agencies and private

landowners. It is, however, evident from these figures that the economic return from wildlife is substantially greater than the expenditures necessary to generate this return.

Ecological Condition

While there is little doubt that the condition of western public rangelands has improved substantially over the past 50 years, there remain substantial areas of publicly managed rangeland in Nevada (Bur. Land Manage. 1975), and I believe throughout the West, in less than satisfactory ecological condition. This is especially true of riparian ecosystems (Bur. Land Manage. 1975, Nev. Chap. Wildl. Soc. 1983) which are so important to a substantial number of range wildlife species (Thomas et al., 1978). These situations are primarily due to livestock grazing impacts and are manifest by reduced carrying capacities for an array of wildlife species. They have resulted in extirpation of some like the Columbian sharp tailed grouse and the California and Rocky Mountain subspecies of bighorn sheep in Nevada. Improved management practices for livestock and range in Nevada have provided the opportunity for reintroducing these species, and such actions are currently in place or are scheduled for the near future.

A major part of the conflict over the condition of rangeland and wildlife habitat has resulted from the traditional concept of the primacy of rangeland use for production of food and fiber by raising domestic livestock. This concept has failed to change in concert with changing societal demands. In fact, the beef industry is currently struggling economically, largely in response to decreased demand for the product despite accelerated advertising campaigns. In the face of this circumstance, the demand for wildlife-oriented uses is very strong, especially for big game hunting, as shown by the Nevada data, and for nonconsumptive uses (U.S. Dep. Inter. 1982).

Conclusions

While in no way, do I propose abandoning livestock grazing on public rangeland, I do contend that livestock grazing is the focal point of conflict with rangeland ecological condition and wildlife habitat maintenance and productivity. While the exact extent and degree of conflict, to be accurately displayed, must be considered on a site-specific or species-specific basis, the range and wildlife management literature has dealt extensively with the subject and has unquestionably documented the conflict. I further base my perception on 18 years of empirical observation in working with wildlife/livestock/rangeland relationships in Nevada.

The time is upon us for a reevaluation of the values of range based on societal demands. I suggest that such a reevaluation will result in new management strategies that emphasize management actions to enhance rangeland ecological condition and wildlife habitat values for the benefit of contemporary American society.

It has not been my intent in this paper to develop a definitive and comprehensive comparison of demands and conflicts for range use, but rather to put forth "food for thought" in hopes of stimulating new perspectives and approaches for evaluating range demands and developing management programs responsive to these demands.

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WHAT NEW DEMANDS FOR USE OF RANGE COULD EMERGE IN THE FUTURE?

By James W. Giltmier[1]

When Wilson Scaling asked me to make this presentation, I was overwhelmed. It is a technical subject, and I am not a technical person. I have done a fair amount of research in my time, and have written several million words about farming and ranching. But my assigned subject would seem more appropriately developed by a guy like Thad Box.

The upshot is that preparing for this 10-minute presentation was like getting ready for a prize fight. I went back through the proceedings of range symposia held in Washington, D.C., in 1976, Tucson in 1979, Twin Falls in 1981, and Elko, Nevada, in 1982. I searched through 200 pieces of literature at the Library of Congress (with the help of a computer, and my friend, Adela Backiel).

Of all the things I read, I was most impressed with an article by Mr. John Merrill in the 1983 Yearbook of Agriculture. Merrill is owner of the XXX Ranch near Fort Worth, and director of the ranch management program at Texas Christian University. In his article "Managing Range for Ecology and Economy" he wrote in some detail about how wise grazing management balances animal numbers to available forage for maximum net return.

He focused on stocking, both according to markets and the condition of the range, rather than even stocking that in some years puts too much pressure on the resource, hindering regrowth and soil protection. In other words, Merrill managed his operation for the way things were, and not the way he wished they were, and he concludes, "I could not have survived otherwise."

As I plowed through the most recent literature on range, here's what I learned: Rangeland is good for grazing cattle and sheep; for fish and wildlife habitat; for fishing and hunting; for hiking, camping, and bird watching; and for siting intercontinental ballistic missiles (if you live on the East Coast). Sometimes cows aren't good for wildlife and fish; wild horses and burros usually aren't good for the cows, because they tear up the range; and not many people like coyotes--especially if they are sheep men (or women). But these are the everyday tradeoffs of a difficult business, and they can be worked out between reasonable competitors for the land. There's room for just about everybody if no one gets greedy.

We have learned that range is an important natural resource; that much has been done to improve the range resource, but more needs to be done. Range administrators need to do a better job of problem solving; they need to involve the public; they need to coordinate with others. We need more qualified range managers. We need better range data that are uniform. Private range managers need to make a profit. And finally, we need more range research.

Having said all of that, I could sit down now because that is what the literature generally says. But if you have been to any of the conferences I have mentioned, I haven't helped you very much. I have decided I can help you best by letting the range scientists talk to you about what is needed on the ground.

My focus is going to be on the marketplace. Our rangelands are in pretty good shape. Why should we spend a lot of public or private money for improved management and research when the markets for the cattle coming off the range have been declining since 1973?

I am going to shift gears on you. If you ask me what additional uses, other than cattle grazing, can be made of the range and if the former president of the National Cattlemen says we have to cull our cattle herds by half, that tells me the beef industry has rolled over and played dead in the face of Frank Perdue's oven roaster, tofu, yogurt, and bean sprouts. That seems dumb to me. You have cut cattle numbers by a third. There's plenty of room for the antelope to play, and

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there's plenty of room for a more profitable beef industry if you look at what the market wants.

Sometimes my cowboy friends get angry when federal policies cause the excessive culling of dairy cattle, or when the federal government isn't managing the public lands the way they think it ought to be done. I think they ought to be focusing their energy on where in the world they are going to sell their beef for a decent price. The other stuff is nit-picking.

After keeping an eye on agricultural marketing for 15 years, it has been my observation that those commodity groups that think they are part of the food industry--I mean all the way down the chain, back to the farmer and rancher--are preparing products for the market as it exists, not as they would like it to be. Your competitors--the poultry, catfish, and rabbit producers--understand this principle and they are increasing their share of the consumers' food dollar.

On the other hand, I see among some of my best friends in the beef business the attitude that anyone who doesn't like a thick juicy steak from a heavy fed animal is some kind of Communist.

That's not true. Despite Julia Childs and the Frugal Gourmet, Americans spend less time in the kitchen. Therefore they like economical, tasty, easy-to-prepare foods that haven't been labeled "harmful to your health."

If the public wants lean beef, why not give it to them with lighter, range-fed animals.

I was going to add some material here about how bad the beef markets have been this year, but you know that or you wouldn't be here today looking for new answers to old questions.

Remember now, I'm talking as a layman. But I have to wonder how we might be able to fit together our concern with range productivity with our concerns about better markets and better prices.

Perhaps what we need is a new approach to research and breeding to enable rangeland to be the last stop for a cow before it reaches the packing house. The Argentinians do it that way. Maybe this is a way to bring new efficiencies and profitability to the cattle business.

Think about it, and then you can tell me if I'm crazy. Today, for the most part, we use the ran to produce cattle, and then we send them to feedlots for finishing.

Then we advertise to our consumers "heavy, aged, fed beef." If there was ever a terrible marketi strategy for the 1980's, that's it. Today's hom maker is traumatized. Her husband has high bloo pressure and is 20 pounds overweight, and every day the news media tell her that the foods she h been feeding her family for years cause cancer o heart trouble. What do those heavy, aged, fed beef ads really say to Mrs. U.S.A.? They say, "Here lady, give your old man high cholesterol. He'll love it."

I can see the smoke coming out of your ears,but don't get mad at me. Let's use our heads to see how we can deal with this marketing problem. I not telling you that all the markets for fed bee are going to evaporate, but the statistics on be consumption and the increasing spread between wh the consumer pays for beef and what the producer gets tell me that we need to react to the market lot better.

Some of the grocery chains have already shown us that there is a market for lean beef. Given tha why can't we use wise management of our range to help meet and encourage that demand?

If we follow the course of this market trend, it may well be that we will once again have to focu on improving rangeland.

I believe beef can compete in this environment. Some packers are working hard to do so. But it also means that the producers have to be cooperators in this situation, thinking less of themselves as riders of the purple sage and more as skillful manipulators of forbs and animals, as well as marketers of super good food to a hungry nation. When that is done, we can focus more clearly on the future demands for range.

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NEW USES OF RANGELANDS

By Thadis W. Box[1]

This paper is not about new products from rangelands, but about new uses, and the expansion of some old uses, of a special kind of land. I think it is a mistake to attempt to evaluate rangelands on the basis of products alone. Many of the products, such as recreation, water, and amenity values, are difficult to evaluate from an economic standpoint, but they may be more important than some of the products that can be evaluated with a dollar sign. For instance, who can say what elbow room or scenic views are worth?

In the past, many people have defined range as a use of the land, and they continue to do so. Livestock grazing--a specific use--has become almost synonymous with range. I think we can best follow the advice of Frances Colbert (1977), who once said:

> "I want to emphasize in the strongest possible way that range - or rangeland or range ecosystems - is a kind of land, it is not a land use.
>
> I must admit that the 'range' has always been associated with livestock grazing (a specific use) on uncultivated lands, and this connotation is still prevalent especially among the general public.... Nevertheless, rangeland comprises at least forty percent of the total land area, not only in this country but in the entire world, so I believe it is time we made a serious effort to recognize range for what it is: a kind of land - a major land resource - from which there is and can be obtained a wide variety of products and values of goods and services."

I will be talking not about products from rangelands, but about how we can market the whole range of products, values, and services.

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Our rangelands are an important national, and indeed a world, resource. They are in better condition then they have been in this century; with the application of scientific management they have continued to improve during the past few decades.

Traditionally, the major use of the rangelands of North America has been stock grazing to produce meat for human consumption. This use is now being questioned, not only by people from the nonranching public, but by ranchers as they now find themselves hard pressed to make a profit.

Ranchers are in a cost-price squeeze that has come about, in part, because of over-optimistic projections of demand for red meat, a decline in the world economic conditions, and competition from the European Economic Community. These factors have forced livestock prices down to a level at which other, nonlivestock, products of rangelands can compete economically for use of the land.

A very good example of how conditions have changed the cattle business can be seen in the continent with the world's fastest growing population, Africa. Even a decade ago, such reputable organizations as the Food and Agriculture Organization of the United Nations, the World Bank, and the International Center for Livestock in Africa, projected a growing economic base for Africa, with an increasing demand for red meat and an active internal market on the African continent itself. These projections, coupled with opportunities to export livestock to Europe and the developed countries, appeared to make livestock grazing in Africa an ideal situation in which to invest capital and human resources. The people in Africa would still like to eat red meat. However, their human population has grown, the economic conditions have worsened, and the projected demands simply have not materialized.

Similar situations occur in Australia, Europe, and other portions of the world where livestock are produced. It has become obvious that if the owners of rangelands are to make profits from those lands we must have a new definition of ranching. We can not survive simply on the

production of livestock products alone. New uses for rangelands must be developed.

To understand what these new uses may be, we must look at who are the potential users of the land, what is being sold from the rangelands, what our culture values about rangelands, and finally, how we can create a market for what people want.

The world population continues to grow at about 1.7 percent annually. This is the equivalent of adding over 80 million people per year. However, most of this growth is in the poorest countries of the world, where there is little chance for the products from American rangelands to find their way into hungry households. Before these people become users of American rangeland products they have first to raise their economic conditions so that they can either buy our products or travel to America to use the services that are available on the range.

A quick look at the demographics of the developed world will show that these countries have slowed down their birth rate. In fact, in over a dozen countries in Europe birth and death have about reached equilibrium. Although the population of the world is growing, the population of our major markets, including those of our own country, is not growing. We are simply growing old.

In the United States our population is essentially stable. We have more people over fifty than ever before in our history . The ranks of the aged are growing. There is no long an official retirement age in many states. The social security system is all but defunct. The care of the old is draining the resources of society. Recent studies have shown that old people from this country are migrating back to the cities, where they can live in closer communion with one another. This change in the population age structure will probably have a more profound effect on the demands made on rangelands than anything that has happened in this country in this century. There will be fewer young people to produce goods and services, and more older people who will demand a different mix of goods, services, and products from the rangelands.

The rich countries of the world, including our own, have a relatively stable human population. They are growing old and they are relatively rich. They can afford products. Much of the third world, though, has a growing human population. They have a surplus of young people, though largely uneducated, but they are poor and cannot afford red meat, wool, or mohair. At least in the short run, we the ranchers in North America will be dealing with those people here at home--the old and the rich.

I think we need to look at what people want from rangelands. I believe we have been mistaken in thinking that what our culture values most from rangelands is animal products. We have wanted to think that because meat, wool, mohair, and hides are all things that have a ready market and are easily sold. They may not be, indeed probably are not, the things that people want most. I would argue that one of the things we value most as a society is the western way of life. People who have been long separated from the range continue to wear boots and silver belt buckles and other items of western dress. They build their houses to imitate the old ranch house. They support western movies, and they seek out other marks of the western frontier.

Ranchers themselves have forcefully demonstrated that what they really value in life is the western lifestyle. Any time an investor, in this case a rancher, is willing to settle for a 2- or 3-percent return on his capital, he is valuing something other than money.

Western hospitality is legend throughout the world, and there should be little doubt that one of the most valuable things about rangelands is its contribution to this elusive and poorly understood western way of life. I will return to this later, but let me leave you with this thought: if ranchers are willing to forgo two-thirds of their investment opportunity to stay on the range, would not a large number of other Americans also be willing to pay for a taste of the western way of life? The trick is in marketing it.

We also value rangelands for beauty, solitude, and wilderness. These, undoubtedly, are major assets. Yet, wilderness supporters and ranchers are often seen in conflict. the conflict is not over values, in which they are in agreement, but over the uses and the availability of lands. People from almost all walks of life value the beauty and wilderness qualities of rangelands. Our task is to figure out how to make these lands available to people who are willing to pay for them.

Rangelands have another important value; they are a place where the undesirable, but often necessary, functions of society can be hidden from the general public. Sanitary landfills, sewage lagoons, and other waste disposal areas are commonly put on rangelands. The more long lasting and dangerous waste from nuclear industries are proposed for our rangeland areas. Army bases, bombing ranges, and other military facilities are often put on ranges.

The problem facing today's rancher is how to market those range products that society values. So far, we have only dealt with the easy ones: meat, fiber, etc., that have a ready place in the market. What is needed is to match the capability of rangelands with the cultural values and demographics of the world's people. In other words, market those things that are not now being sold.

I would reemphasize that our major asset is the cultural tie to the western way of life. Our major consumers will be citizens growing old in a rich nation, a nation that is switching from manufacturing and production to service industries, a nation where most of the people live in urban areas. It is unrealistic to expect our country to change to meet the needs of the ranching industry. What is realistic, in fact even essential if rangelands are to meet their full potential, is for the ranching industry to change to cater to the demands of an aging urban based population.

The obvious place to start to change is in those areas where demand has already been established. Recreational uses can be expanded greatly. The idea of charging someone for western hospitality is repugnant to many, but there are people who would be willing to pay for experiencing ranch life.

In England today, bed and breakfast inns are in great demand for tourists. Many of these are operating farms; the farmers take in a few tourists throughout the summer in order to support the farm. Not only do these bed and breakfast farms provide an income for the farmer, but they also educate a wide segment of the public.

We have a new provost at Utah State University, a physicist with no experience in the West. In order to educate him, we took him to several of our range livestock projects, including one in Morocco. People in range and livestock showed him what we were doing, why we were doing it, and why he should be interested in livestock production. On his way home he took a few days to rest in England. He stayed at a bed and breakfast farm in the English countryside where the owner raised sheep. Three days working with the farmer taught our provost more about the sheep industry than all of our efforts in Utah and Morocco. He was able to have a hands-on experience, and <u>he paid for it</u>.

There is a great demand for nostalgia. Currently there are a number of living historical museums growing up throughout the country. One of the most famous ones is at Williamsburg, Virginia. More recently, Texas Tech established the Ranch Museum to show how ranchers lived. There are now literally dozens, if not hundreds, of privately owned historical farms throughout the country. Our University has recently established a curriculum to train curators to develop these museums. There are many operating ranches today that, with a minimum of effort, could switch their operation into a living historical museum and charge people for reestablishing their roots and ties. It might be more economical for a rancher to consider going back to horses and the chuck wagon, rather than bring in four-wheel-drive vehicles and motorbikes.

Last year I spent a sabbatical in Perth, Western Australia. One of my coworkers there, raised in the city, had never spent time on a farm or a ranch, even though Australia is primarily a rural

country. For his vacation he went to Queensland and visited a tourist farm. He came back telling of his experience and proudly hung a certificate on his wall stating that he had milked a cow. It might be that if some rancher should decide to establish a tourist ranch and give certificates for people who have saddled a horse, he would produce more income than with his livestock herd. Private youth camps where young people are charged to do ranch work have a real potential. Many people in America today are willing to pay for a hands-on experience on a private working ranch.

Within the last year, I have visited two areas, one on private land and the other on a national forest, where movie companies have paid for the right to establish movie sets on rangeland. There are many people willing to pay for experiencing the western lifestyle--old people, people searching for their roots--for whom innovative and new enterprises can be developed that will provide needed services and at the same time turn a profit.

Within the recreation area alone there are many opportunities. In Texas and some of the other private land states, some ranchers now make more from the sale of hunting and fishing privileges on their land than they do from livestock. A few years ago, a rancher outside of Perth decided to pen his sheep on the weekends and allow people to run four-wheel-drive vehicles, motorbikes, and three-wheelers across his property. The demand was so great for a place to drive off-road vehicles that he soon sold his sheep and now simply has someone at the gate every weekend to admit people to drive their machines over his country.

A few ranchers in America have already begun put-and-take hunting and fishing operations. There is a great opportunity to expand these with exotic animals that do not come under state game and fish laws.

Ranchers have only begun to tap the potential market for native plants. When steel posts replaced wood posts, the value of woody plants was forgotten. In fact, most people considered them as pests--brush to eradicate. With the increasing popularity of wood-burning stoves, fuelwood has now become valuable. Mesquite wood is marketed in little packages from New York to Los Angeles. Only a few ranchers have capitalized on planned fuelwood harvests as a means of improving rangelands.

One of our projects in Brazil is designed to produce income from posts, construction timber, and fuelwood, while at the same time improving the foliage for livestock by increasing the herbaceous growth and the coppicing regrowth from desirable woody plants. I find it ironic that we are doing this in a developing country, but have not taken the time and opportunity to do it in America.

There is a great demand for landscaping material from rangelands. The public range manager around major cities spends hours and money trying to prevent people from destroying the landscape by digging up native plants such as cacti and particular shrubs. Few ranchers have recognized this as an opportunity. There is a strong, though limited, demand for artistic materials such as dried plants for flower arrangements and specialty woods. Plant products that are tied to holidays, such as mistletoe for Christmas and autumn leaves for Halloween and Thanksgiving, can be, and indeed are, marketed in some local areas.

In some areas, food products are sold from rangelands. These include pecans, walnuts, and piñon nuts. Many of the ranchers in my native Texas have largely ignored their native pecan trees because of the lack of labor, problems of insect control, and other production problems. Very few, if any, have tied these to a personal experience by letting the consumer do the harvesting. There is a great potential for outdoor experiences such as nut-gathering and berry picking, in which the consumer provides the labor. A number of Christmas tree farmers have discovered that it is easier and far more profitable to have the consumer cut his own tree than to cut it and haul it to him.

I have not talked, nor do I plan to talk, a great deal about the development of new plants for rangelands. There are other papers on this program that will treat it in detail. I do want to mention that biotechnology is available to

improve native plants and perhaps even create new plants to improve food production on rangelands.

One of the needs of society is to dispose of its waste. Rangeland is a logical place to put much of it. The problem is, how does the land owner or the taxpayer, if it is public land, recap fair market value for this desire and need of society? In some isolated cases, sewage water or sludge can be used to grow forage. But in most instances, there will not be a direct economic gain. In fact, in most cases there will be damages to rangelands, and society should be willing to pay for those damages. Creative ideas as to how this can be accomplished could help establish whole new markets for rangeland.

I believe that if ranchers are to gain the maximum return from rangelands, they are going to have to concentrate first on quality in their traditional products. There will always be a demand for high-quality meat, fine wool, and the best mohair. The greatest potential for expanding into new areas is in creating new ways to market the traditions and the values of ranges and rangelands.

In closing, I would argue that there are many new uses of rangelands, and that we are limited only by our imagination and our willingness to accept the changes that marketing these new uses will bring to the ranching industry. To capitalize on the opportunities and new markets, the definition of the rancher must change from someone who raises cattle and grass to a businessman who markets what society really values from these rangelands. My belief is that what society really values is western hospitality and the western way of life. If we charge for it, and if we sell it, we may in turn destroy it. But, if profit from rangeland is what we want, we will move quickly, forcefully, and imaginatively. We will look for ways to help people experience a little piece of the ranching industry and still keep those values that made the ranching industry and rangelands what they are today.

CONFLICTS IN THE USE OF RANGE--
CAN THEY BE RESOLVED?

SUMMARY

By Frank Gregg[1]

The panel on conflicts was interesting because it chose to operate outside the framework of the immediate agenda, the immediate conflicts which face us in managing public rangelands.

The environment of the future was the subject of attention by Thad Box and Jim Giltmier. Thad pointed out that there are going to be a lot more people in the world and that on the face of it that appears to imply opportunities for new markets for traditional rangelands projects. He then noted quickly that most of the population growth will occur in regions which are not going to have the money to pay for additional rangeland products; that domestically our population is going to be older; that the dietary preferences are going to likely continue to feature less red meat per capita; and that the economic outlook for traditional rangeland products, revolving around red meat production, is not particularly bright.

At the same time, and on a similar theme, Jim Giltmier was addressing the difference between what the public wants, appears to want, in terms of traditional rangeland products and the inertia in the range livestock industry in continuing to emphasize production of kinds of beef and of beef products which the public doesn't seem to like. Jim has a marvelous line in his remarks that the livestock industry's continuing emphasis on traditional heavy beef had the effect of telling the housewife that she should be going out and buying her husband more cholesterol because he'll like it no matter what the health people are saying. Jim talked markets and marketing as the key to the future in terms of the economic opportunities for new, conveniently packaged, easily prepared, low-fat beef products.

It's interesting that both Thad and Jim talked about future opportunities and conflicts primarily in terms of those who are engaged in making a living on the rangeland, of helping producers adapt to the different markets for products. Thad went on to outline some opportunities for new products, including the delightful idea of suggesting that the more photogenic of the livestock operators on both public and private lands should designate themselves as living historical museums, develop a variation of the English bed and breakfast idea and become colorful providers of sustenance. Several known to many of us would fit that role very well. There are others who I find some difficulty in visualizing.

I think both Jim and Thad were dead serious and effective in suggesting that the sustained application of our collective intelligence to redefining the range of rangeland products will produce opportunities for increasing income of people who have historically built their income potential around range livestock.

An aside: I am struck by the lack of transferability to the domestic scene of an approach we have been taking in our technical assistance program abroad, where we are advising foreign countries both in rangeland ecosystems and in agronomic ecosystems, to address their problems in what we are currently calling a "farming systems" context. Farming systems approaches typically call for a comprehensive approach to management of both cultivated and noncultivated land for crop, livestock, fuelwood, water harvesting and other uses, both on individual and community scales, and covering finance, credit, marketing, transportation, etc., as well as production. The concept has proved useful in getting systematic assessment of the problems and opportunities of agricultural regions in developing countries. I'm curious that we have not formulated or conceptualized that idea as a was of organizing approaches to the kinds of questions that Thad and Jim were raising. We still seem to be tied to traditional mixes of outputs and markets. Perhaps that is in part the fault of those of us in research and education.

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Willie Molini, the director of the Nevada Department of Wildlife, followed this discussion. In fact, I think he preceded parts of it, but for our purposes, he followed it very neatly by pointing out that at the same time that demands for traditional livestock products on rangelands are declining, other demands are increasing. While we have what amounts to surplus productive capabilities for red meat, we are in a deficiency situation in our capacity to supply other kinds of demands. Of course, Willie was talking especially about wildlife, and particularly about forms of wildlife that are attractive for hunting purposes. He was able to point out that Nevada is not able to deliver on anything like the number of hunting permits that people would like to have, and are willing to pay for, for elk, or big horn sheep, or antelope, or other prime species. (That's generally true in most of the Western states for the most currently "attractive" kinds of animals.) Willie translated Nevada's situation into some numbers which wound up, as I recall, with a figure of $146 million a year in economic activity generated by hunting and fishing in Nevada. He did not include in his economic calculus economic activity generated by wildlife viewing and other nonconsumptive kinds of recreation which are based on wildlife. Nor did he include any economic estimates of activity generated by the sort of wildland recreation activities that are not exclusively associated with wildlife--backpacking, rock-hounding, etc.

The juxtaposition of the Box-Giltmier and Molini presentations underscores the possibility of improving the economic potential of some rangeland ranches by finding ways for ranchers to contribute tangibly to the benefit from growing demands for wildlife.

In any event, all three appear to be talking about demography as well as shifting public preferences in diet and leisure. The West, particularly Colorado, the Sunbelt, Nevada, and the Pacific rim, is growing. Most of the growth is in the cities. Most of the people who live in the cities tend to look to the rangelands for entirely different things than the region's rural residents.

We come closer to the question of conflict resolution, and particularly to resolving conflicts between rangeland ecosystems as traditional production systems for food and fiber and rangeland ecosystems as sites for the enjoyment of scenery, recreation, wildlife, wilderness experience, and so on, in Rex Cleary's remarks on the stewardship program. "Stewardship" as a label has evolved over the last 6 or 7 years since PRIA (Public Rangeland Improvement Act) as a series of experimental efforts to explore ways to encourage public land livestock grazers and other users of public lands in that area to respond to the management of the public rangelands in a cooperative rather than confrontational way. It's a curious accident of history that while Congress gave the Forest Service and BLM (Bureau of Land Management) very broad authority to try all kinds of things in the name of stewardship, in practice, most of the effort went into trying to develop on-the-ground ways of bringing parties in conflict working more closely together on specific rangeland ecosystems.

Rex had some excellent observations about that approach to conflict management based on his experience out of the Susanville District of BLM in California. The Stewardship idea has worked in several areas of the West, although not without a level of communication and cooperation that is difficult to sustain over time.

The most depressing thing Rex had to say was the news that people who are working on cooperative planning and management as a way of bringing parties in conflict to the point of seeking honorable compromise have been undermined by bureaucratic competition between "stewardship" as a label and such other labels as coordinated resource management planning. That sort of nonsense we don't need.

Rex had some suggestions (which you will find in the proceedings) which I thought were realistic ways to proceeding from the experimental stewardship programs toward some more broadly applicable ways of encouraging local people to get together to seek solutions on a basis of the best ways of managing resources instead of by competing in the courts or in administrative appeal procedures.

Cormick spoke about mediation with some delightful specific examples drawn primarily, and most interestingly, from offshore oil and gas exploration and conflicts between established users (commercial fishermen) and new users (oil and gas exploration outfits). I found his principles to be immedi- ately applicable and relevant to the kind of con- flicts that we encounter in rangelands. After all, what is going on on the outer continental shelf is an attempt to move toward multiple use of the resources of that region. I'll come back to Cormick's comments later.

What's most interesting about what the speakers said and what the audience chose to comment on is the fact that the most dramatic of current conflicts were not mentioned at all. People questioned whether Box's and Giltmier's proposals were really economically relevant, and questioned some of Molini's implications as to relative economic value of livestock and wildlife.

What was not talked about was the whole kit of controversies wrapped up in the so-called omnibus rangeland bill, including the public land grazing fee, continuation of grazing advisory boards, the question of priority protection of riparian values, the wild horse and burro dilemma, and others. The grazing fee was not mentioned in the two sessions that I sat all the way through. Riparian ecosystem protection as a legislative objective in an omnibus public rangelands bill was not mentioned. The grazing advisory boards issue and the relationship between the grazing advisory board and the multiple use advisory boards and the multiple use context generally were not mentioned. Neither were any one of the other issues around which, even as we speak, lobbyists in Washington are engaged in mortal warfare.

The conflict panels succeeded in talking about range, new opportunities for use of the range, and the changing environment within which we are going to be managing the range over the next 10 to 20 years without being dominated by the grazing fee issue or by arguments about levels of livestock grazing. That may be a historic first, and may be welcome. Or it may be that this simply reveals Cormick's characterization of how we tend to deal with conflict. Cormick outlined a 10-point discussion of what mediation is and how it works. He began by pointing out that people in the presence of controversy cannot be candid about what's really on their minds. They tend not to reveal what their real concerns are. They're also very careful not to reveal what their preferred courses of action are. They tend to keep their cards under the table, in other words, and I have a curious feeling that there are an awful lot of strong feelings in this room about rangeland conflicts which did not surface at this conference.

I suspect, in fact, that minimizing controversy might have been in the minds of the conference planners in influencing how the sessions were structured. But whether or not that's the case, it certainly came out that way. That doesn't mean that these conflicts do not exist, so let me say a few things about what the conflicts really are.

I remain convinced that the ultimate question facing management of the country's public rangelands is whether we can develop support, effective sustained public support, for the management of these systems as renewable resource systems. I don't think it is clear that we have enough public interest or support to sustain effective and serious programs for management of rangelands as renewable resource systems. The reason, of course, is because the systems are not all smashingly beautiful in the national park/wilderness image, and are not immensely productive on a per-acre basis. To the unknowing eye many of our rangelands may appear to resemble wastelands insofar as renewable resources productivity is concerned.

In conflict with other uses, renewable resources many tend to lose out. If you have conflicts with energy resources, the economic disparities are likely to be striking. Where cities look to rangelands for urban development need, those needs are going to be met. Transportation needs are going to be met; missile basing needs are apparently going to be met; where we've got oil, gas, and geothermal resources of significance, those resources are going to be developed.

What's not clear is the kind of support we may have for the management of the vegetation of the

rangeland ecosystems for all the economic values we can generate and for the maintenance of these ecosystems as wild and open lands which produce the special recreational and aesthetic values of wildlands.

If we are going to achieve the kind of support we need, we'll have to achieve what Dale Jones has been quoted as saying is necessary: We have to measure and display the full range of rangeland values as reinforcing and cumulative rather than competitive. We have to demonstrate that public benefits can be expected to be realized from investments in managing rangelands. Obviously, we can't do that on the basis of single uses. That means we need to do a much better job of quantifying benefits in terms of water yields, water quality, sedimentation and erosion control, recreation, wildlife, wilderness, archeological and cultural resources, etc., as well as the traditional economic uses such as grazing.

In order to pool our interests in any cooperative sort of way, we have to be able to reassure the people who are trying to make a living directly on the public lands that identifying the values of these other uses is not going to be used to deprive them of any opportunity to make a living. We also have to be able to assure recreation, wildlife, and environmental interests that livestock grazing can indeed be compatible with environmentally sensitive multiple use management.

The essential problem we face is that we have been unable to develop a genuine community of interest among the traditional producers on the public rangelands and the clientele which is concerned for environmental, recreational, and wildland values. We haven't been able to develop enough sustainable political coalition to pursue the management of these large, immensely productive (in whole, not per unit of area) rangeland ecosystems.

At the moment, I don't see any evidence of the prospect of a coalition getting any closer. I worked very hard on that when I was BLM director. I think a major reason for our immediate difficulties in coalition-rebuilding may be a legacy of former Secretary Watt, who made it clear that environmental objectives were going to be downgraded (which was arguably sensible as a policy choice), but went on to emphasize that environmental leaders weren't welcome in the key decisionmaking processes. He was quite explicit about that, and the prospects of coalition building continue to suffer.

Let me make these three suggestions on ways that I think we might move back toward a coalition. One would be--and I'm talking about public rangelands primarily--for Max Peterson (U.S. Forest Service) and Bob Burford (BLM) to build on the working relationship they have, which has been very useful for looking at issues such as land consolidation, and ask those two to take on the development of a sustained dialogue with leaders of the affected rangeland interest groups in exploring ways that their interests could be made more compatible through cooperative planning and sensitive management. Congress will have to deal eventually with major policy questions. In the meantime, there is no substitute for strong signals from agency administrators that all interests are going to be heard, and that cooperation will be encouraged.

If necessary, I would suggest that they and we consider the possibilities of bringing professional mediators in to deal with specific issues. I think that is a possibility. If you draw a list of the dozen or so issues that separate the conflicting parties, I would guess that four or five meet Cormick's tests of what is needed to make mediation possible. Resolving some of these outstanding issues might be immensely helpful in creating the sense of accomplishment which might make it possible to address the others.

A second thing we need to do is to develop some interdisciplinary collaboration in research addressing issues of rangeland use and allocation and the impacts of use. These are central to many of our controversies. As for instance, the riparian issue.

One of our persistent problems is that we do not have credibility for many of the scientific efforts that are being directed at managing rangelands. I can tell you that the environmenta

community as a whole has a very low confidence level in the profession of range science; they see the profession as having a client-type relationship with the domestic livestock user. I'm sure precisely the same feelings can be expected from resource commodity interests as they contemplate outputs of research by wildlife professionals.

Harry Hodgdon (the Wildlife Society), I've suggested this before: I really think we need to find, to acknowledge, that lack of confidence in professional objectivity is a specific problem in managing rangeland ecosystems. We need, it seems to me, to see if we can develop some pattern of interdisciplinary research cooperation which will produce credibility on technical matters, with the kind of results that our riparian speakers were talking about yesterday. I don't think that's impossible to do; perhaps we could begin by trying to develop some common public posture on methods for classifying, evaluating, and monitoring riparian ecosystems. Platt suggests we now know enough to manage sensitively for multiple values. Can we find a way for professionals to speak in some concert on the technical (if not the allocative) issues involved?

Finally, I should acknowledge that we have a long-range job to do in the field of professional education. I won't go into that here, but my own observation as an administrator of natural resource agencies and for a few years as administrator of an interdisciplinary professional school, is that we continue to train, to do an excellent job of training, technicians. We do a very poor job of training what I would call environmental philosophers and integrators who are capable of leading society toward applying our technical knowledge in the messy field of politics and public preference. I hope that those of us in education can find ways to do better by the rest of you.

Thank you.

RESEARCH AND TECHNOLOGY--THEIR IMPLICATIONS FOR RANGE MANAGEMENT IN THE FUTURE

MODERATOR'S REMARKS

By Evert K. Byington[1]

Do advances in research and technology have the potential to significantly affect range management in the future? A few years ago no one would have asked this question because the answer was so obviously yes. But today more and more people doubt that research and technology is part of the solution to the challenges facing American agriculture.

This country has a huge agricultural research and development infrastructure that traces its beginnings back to the land grant system. But despite 100 years of significant changes in farm and ranch technology we find the agricultural sector in the midst of its greatest crisis since the Depression. All our efforts in research and technology have not resulted in an agricultural system that is ecologically, economically, or socially sustainable. No wonder there are people who question if "more of the same" from our research and technology community is really what we need.

Agriculture, including range and forest management, is the critical interface between the human race and the rest of the biosphere. Only two calamities currently appear to have the power to end civilization as we know it: nuclear war and the breakdown of the agricultural interface. One of the most serious shortcomings in the research and technology business has been to lose sight of the importance of the interactions across the agricultural interface. The natural resource base is managed to produce goods and services wanted by society. Sustainability and stability demand a balance between supply and demand.

For too long the research and technology community tended to ignore the critical interactions between society and management of the natural resource base. We have focused on producing better things and not on balancing interactions between society and the range and other land types. Only recently has political reality forced a more holistic approach to managing our public rangelands in response to demands for multiple uses on a sustainable basis.

Today, economic reality is telling us we need to develop research and technology outputs that can help the range to efficiently operate all along the agricultural interface--an interface demanding conservation, profitability, and high productivity of multiple goods and services. Research and technology can play a vital role in the future of range management <u>if</u> it targets the interface between the natural sciences, the range, and social reality. Yes, we need new and better things from research and technology <u>when</u> they will enhance the balance across the agricultural interface.

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BIOTECHNOLOGY IN PRODUCING RANGE LIVESTOCK--ESTABLISHING GOALS AND FUTURE OBJECTIVES

By James M. Eller[1]

Cattle prices in recent months have reached their lowest level in 7 years. Even worse, these low prices are part of a longer, downward trend during that 7-year period. Prices have not kept pace with inflation or economic growth. Meanwhile, cattle production costs have increased one-third during these past 7 years. These factors, coupled with lower consumer demand for beef, create a dilemma for cattle producers. Beef producers have not improved production efficiency, as have producers in competing industries. Future profit opportunities for the cattle industry lie with increased efficiency of production. Many of these opportunities will result from biotechnology.

Suppose you are a commercial cattle producer faced with this dilemma. You operate on a fairly large scale. You have always been a good manager. But in spite of your ability you are having cash-flow problems. You are on the verge of bankruptcy. Even though you have always run good quality cattle and had a fairly high performance level, it is becomming hard to get enough credit to operate. You may have to sell some land. But land prices are down, and few buyers are around to buy ranch land. How are you going to survive this crisis? What are you going to do to become more efficient and again operate at a profit? Tremendous advancements have been made in space technology and electronics; surely, someone can apply "high-tech" to the cattle industry.

Suppose we want to order cattle built to our own specifications. What would we require? Let's assume a basic operating plan to use existing range forages produced from land not tillable, while maintaining maximum stocking rates and cash flow and producing an annual return on investment from land and livestock. Where do we start?

Suppose the type of cattle operation we require is like this:

- o Maintain a cow-calf operation, coupled with a grow-out program for all weaned calves to fully use all available forage.
- o The average cow in the herd weighs 1,100 pounds for efficiency; her calves average 70 pounds at birth, but wean at an average of 700 pounds at 6 months of age.
- o At weaning these calves are turned out for grazing for a 3-month period and average 900 pounds at 9 months of age.
- o They are owned through a finishing period at a feed yard, where they weigh 1,200 pounds at 11-1/2 months of age.
- o All of these animals are steers, because 90 percent of the cow herd was bred by bulls that only produce male calves.
- o All of these steers have the correct fat-to-lean ratio with the grade and yield level most desired by the retailer who purchases them directly from the producer. Because these animals are superior in quality and cutability, a premium is paid above normal beef prices.
- o These steers are in great demand because they possess known cutability traits. All are identical animals produced from parents that are full siblings with high-performance traits.
- o The replacement cow herd represents the best breed to produce breeding females. All give birth to at least one calf every 11 to 12 months. These cows always produce a calf crop exceeding 100 percent on a 350-day calving interval. This herd, used to produce the replacement females, represents only 10 percent of the total cow herd because the cows only produce heifer calves, bred from bulls who only produce females.

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- All of the bulls are purchased from a breeder who has the technology to produce males with the ability to produce calves of known sex and performance. Even though they may cost a little more, due to their fertility and longevity, not as many bulls are required, and the replacement period is widened significantly.

- All of the cattle in the herd are extremely efficient in converting forages and grains. The same is true of their fertility. This is because there are never any illness or disease problems. These animals possess the genetic traits to make them resistant to most diseases as well as parasites. For the few situations where natural disease resistance may not be sufficient, a drug produced biotechnologically from natural produces provides a quick, complete cure.

Can we realistically expect to find someone to "build" these high performance cattle today? The answer is yes. Even though this ideal cattle operation may sound far-fetched, the technology exists today to breed cattle that possess all of these traits. The process must begin by establishing goals and objectives for research and development scientists in biotechnology. The commercial livestock producer today desperately needs rapid improvements in technology to help him improve efficiency and achieve profitability. And he needs it soon.

BIOTECHNOLOGY IN PRODUCING RANGE LIVESTOCK

By Joseph M. Massey[1]

We are now entering a new era in animal production in which we can no longer expect just to use good management principles to produce livestock. We no longer have the luxury to say artificial insemination and embryo transfer techniques are unnatural. These techniques have become part of our everyday management. They have so matured that they reach not only the top purebred breeders but also milk producers in many parts of the world, who use embryo transfer for importing top genetics to increase production. The advancement in biotechnological research has far surpassed imagination and it's time for us to become creative with our thinking. It's time to become [illegible]ble as to where we want to go and how we get there. Research alone is not the answer. The producer must recognize his or her goals and strive to achieve them using all the resources available. Without risk there is no reward. The risk of creativity may be the difference between surviving and not surviving.

By the end of the century, cattle breeding along with other forms of animal breeding will be a completely controlled procedure. We now have the ability to alter the estrous cycle of cattle, but with recombinant DNA techniques we will be producing gonadotrophins as well as any other regulating hormone that will allow us not only to alter the estrous cycle but to initiate cyclic activity in a post-partum cow and to initiate estrus in prepuberal heifers. The ability to control estrus will allow appointment breeding or embryo transfer. The pregnancy success of appointment breeding should be far superior to current techniques and eliminate the need for estrus detection, thereby reducing labor costs. Initiating estrus in heifers will increase use of superior genetics since in theory your heifer and bull calves represent your best genetics.

1/ President, Granada Genetics, Inc., Bryan, Texas.

Embryo freezing techniques are being perfected so that embryos can be successfully frozen and thawed to achieve pregnancy rates equal to fresh embryos. The ability to freeze embryos has reduced costs because livestock do not have to be transported. Hundreds of embryos may be moved in a liquid nitrogen tank for about $600 to $800 to most places in the world. On the average, exporting one animal costs $1,200. We can determine the sex of 7-day-old embryos in controlled laboratory conditions today with an 80-percent accuracy, and it is just a matter of time before the success rate reaches 100 percent. With the advancement of recombinant DNA techniques, DNA probes have been developed to help determine the sex of the embryo. We can now determine the sex of sperm, but unfortunately the techniques are deleterious to the sperm cell. But, it is only a matter of time before techniques will be developed to separate the male and the female sperm cells.

Techniques for superovulation, essential for embryo transfer, will become much more efficient, producing upwards of 100 or more eggs per superovulation. The new generation gonadotrophins such as FSH, which are produced by recombinant DNA techniques and are identical to what is found in the bovine, are likely to achieve these goals within the next 2 or 3 years. Those techniques will allow us to understand the exact mechanisms that effect superovulation in all farm animals. This new knowledge should help our biochemists construct the exact molecules that control the exact number of embryos produced per superovulation.

Embryos can routinely be divided to produce two or three identical offspring, but techniques to clone embryos may make it possible to produce hundreds of identical offspring. Cloning techniques are advancing daily, and within the next 3 to 5 years, production of multiple identical offspring will be routine. Cloning is another form of sexing embryos because, in theory, hundreds of copies may be produced, thus allowing all but a handful of the embryos to be frozen. The handful that get transferred to produce offspring will be judged for sex and performance. The multifaceted implications of such techniques as cloning are the

real challenge to the producer, who needs to be aware of what is available today to drive production costs down and demand up for his products.

Rapid advances in recombinant DNA techniques and gene splicing allow scientists to prepare genes or portions of genes to introduce into a fertilized egg thus producing a permanent desired effect, which will be passed on to each new generation. In the past several years super large mice have been produced by introducing growth hormone genes into a fertilized mouse egg. By introducing genes that affect growth, hopefully we can produce animals that grow faster, more efficiently convert the same feed stuffs, mature earlier in life, and are multiparous. Also, perhaps, we can introduce genes for disease resistance and thereby avoid having to immunize through vaccination. Currently, several laboratories are reporting successful integration of genes into swine and sheep. Gene mapping is currently under experiment in many university laboratories. As our abilities to construct genes are enhanced, it becomes more important to know what traits are controlled by which genes and on which chromosomes.

It is only a matter of time before a producer will be able to specify the sex, size, and traits best suited for a particular environment. No, I do not believe that in the next 5 to 10 years we will be able to produce offspring that are routinely genetically manipulated. But yes, many of the capabilities are with us today, and science will continue to make more tools available to us each year. Science will not make us better producers of animal protein. But the livestock producer who is creative enough to dream about tomorrow and make his dream come true by incorporating biotechnology into his management will be tomorrow's producer.

BIOTECHNOLOGY IN RANGE VEGETATION

By Cyrus M. McKell[1]

Introduction

Biotechnology holds great promise for improving rangeland vegetation. The various strategies being developed in the biotechnology industry are not limited to those in the field of molecular biology, which is commonly described as genetic engineering and incorrectly used to characterize biotechnology in general. Indeed, the field of biotechnology is much more extensive and includes all of the fields of biology that are amenable to technological innovation and application. Full success in biotechnological development requires linking several biological and agricultural disciplines. For example, molecular biology provides the basis for genetic engineering when linked with tissue culture, plant genetics, and ecology.

Rangelands and semiarid pastures with sites of high potential productivity but currently rated at less than optimum productivity and stability are logical candidates for range improvement. The most logical time to utilize biotechnology-improved plants and products is when an opportunity for adding to, or replacing, low-value rangeland plants is available. While some may see this as a departure from the time-honored dogma of ecological management of rangelands, in reality it is merely adding a new set of biological tools to those already available to the range manager. Thus, it is important for the range manager, and the range industry in general, to understand the basic principles underlying biotechnology and how to use the opportunities biotechnology can create to solve such rangeland problems as low plant productivity, infertile soils, toxic plants, low plant nutritional value and unpalatability, lack of plant vigor, and susceptibility to pests and diseases.

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The plant biotechnology industry is developing rapidly, with successful companies being created and losers being eliminated. According to a report by the Office of Technology Assessment (1984), more than 54 biotechnology companies were working in plant research in 1984. The expected trend is for some of the smaller companies to merge with larger ones. As the industry gains strength it will increase in its ability to fulfill the promises made to investors. New products are scarce but are now beginning to appear (Bylinsky 1985). Companies with an existing product base in agriculture are the ones most likely to be successful. The industry is generally concentrating on high-volume crops and products where existing market opportunities are the most attractive. However, specialty opportunities that can be approached with a lower research cost because some of the research has already been done will also draw interest. Astute management requires that the investment for research be commensurate with the market value of the expected products. Thus, many interesting rangeland plants and biological processes may not warrant the attention of commercial biotechnology companies, particularly if there is no existing research base on which to build a research and development program. Therefore, if range vegetation problems are to be considered by biotechnology research, the public as well as the private sector must be provided the incentives to work on such problems.

Opportunities to Use Biotechnology

The major opportunities to apply biotechnology to rangeland vegetation will occur when making a change in species composition, such as in range improvement by reseeding or interplanting improved plants. As pointed out by the National Task Force on Basic Research in Forestry and Renewable Natural Resources (1982), expanding genetic limits to growth and extending the range of physiological growth limits are two important areas that hold promise for increasing rangeland productivity. Biotechnology, often working in concert with conventional technologies, is the means by which plants with superior characteristics can be made available to the range industry. The alternative is to wait many years for conventional technologies to provide the improved products.

There are also opportunities to use rangelands for plantations of genetically improved specialty plants such as jojoba (Simmondsia chinensis) (Nat. Acad. Sci. 1985), guayule (Parthenium argentatum) (Vietmeyer 1979), or mesquite (Prosopsis juliflora) (Felker 1979). Growing these plants on low-value lands, under some degree of intensive management but within the natural constraints of the ecosystem, will produce new products that will benefit the national economy.

In certain cases it may be possible to improve productivity or reduce the ravages of plant pests by making a general application of a new product to rangeland vegetation. One possibility is a biological insecticide developed from secondary metabolic products that have evolved as protective chemicals in plants for natural control of insect pests (Klocke et al. 1985). Another approach may be to apply a select strain of mycorrhizae to inoculate the roots of plants to improve the uptake of phosphorus and water and give some protection against root pathogens (Call and McKell 1985, Wood 1984).

Obviously, major policy changes will be required in some cases to allow departures from present combinations of land uses and permit the application to functioning ecosystems of new plant materials or organisms that have been altered by a DNA transfer. At present, methods for producing DNA-enhanced plant materials are being developed to facilitate the transfer of naturally occurring genetic traits. Extensive laboratory and field testing will be necessary before plants and microorganisms will be available. However, the administrative and social climate must be favorable to consider the use of these and other new materials.

Means of Applying Biotechnology

Plant improvement

One of the most important means by which biotechnology may benefit rangeland vegetation is through genetic improvement of plants using a combination of plant breeding, tissue culture techniques, and recombinant DNA technology. The result will be the identification and transfer of desired characteristics to produce superior plant species useful for forage, biomass, wildlife habitat, or watershed protection. Before any intensive genetic improvement programs can be undertaken on range plants, a clear understanding of the biology, diversity, and genetic relationships of those plants is necessary.

In contrast to the great accomplishments in breeding of agronomic crops such as corn, limited progress has been achieved in range plant selection and development. Several reports presented in a symposium at the 38th annual meeting of the Society for Range Management describe the status of range plant improvement. In the proceedings, Asay and Knowles (1985) listed seven new cultivars of wheatgrasses and wildryes (Agropyron, Elymus, Elytrigia, Psathyrostachys, and Leymus) that are superior in yield and stress resistance to the original introduction or native species. Ensign (1985) described research progress with fescues that mainly emphasizes ecotype selection from the known amount of diversity. According to Jacobson et al. (1985), plant improvement activities in bluestems (Andropogon spp.) concentrates on using conventional techniques directed toward development of grass cultivars better adapted to stress environments of the Great Plains and adjacent areas. Grass breeding programs of the various U.S. Department of Agriculture (USDA) plant materials centers and agricultural experiment stations seek to develop adapted varieties with increased forage production, seedling vigor, and resistance to disease and drought. Vogel et al. (1985) stated that much of the breeding work in switchgrass (Panicum virgatum), indiangrass (Sorghastrum nutans), and eastern gammagrass (Tripsacum dactyloides) involves collecting a large array of native accessions, screening them in a common nursery for various traits, and then multiplication and release of the superior selections as new cultivars. A few cytological studies are being done on selected species. According to a report by Heizer and Hassell, grama grasses (Bouteloua spp.) have been screened by numerous plant breeders to produce cultivars of greater productivity and adaptiveness to rangeland prairie sites. Between 1940 and 1984, 12 cultivars of sideoats grama were developed. Blue grama (B.

gracilis) is the most important and widespread species of the genus Bouteloua, but only two cultivars have been developed in spite of the wide genetic diversity from which to choose. A review of plant improvement of the lovegrasses (Eragrostis spp.), dropseeds (Sporobolus spp.), buffelgrass (Cenchrus spp.), and cotton top (Digitaria spp.) was presented by Voight and Oakes (1985). They pointed out that few selections have been made in species of these grasses even though considerable genetic diversity exists.

Rangeland shrub improvement is currently limited to a few important genera that have special attributes useful for livestock and wildlife browse, habitat improvement, and energy biomass. In spite of its generally low desirability as forage, sagebrush (Artemeisa spp.) has a high genetic diversity. Some selections are high in protein content and are palatable to wildlife (McArthur et al. 1985). Stutz and Carlson (1985) report considerable success in the selection and breeding of three superior cultivars of salt bush (Atriplex caniscens). This diverse shrub species as well as several closely related Chenopod genera are high in protein and are desirable as winter feed for both livestock and wildlife. Monson and Davis (1985) report that many superior ecotypes of rosaceous shrubs have been identified but no named selections have been made. Many important browse species are represented in this family, but because of the time required for genetic studies and the lack of a particular location on which to focus breeding work, plant improvement efforts center on gaining a better understanding of the diversity and biology of the various species.

From these reports, we may conclude that improvement of range plants is still in the early stages of development and concentrates primarily on characterizing genetic diversity and ecological suitability. Results of this research work are being made available to the range industry by the selection of superior genotypes and production of foundation seed for release to agencies and seed multiplication institutions. The next step will be to switch from the exploitation of naturally occurring genotypes to breeding. This is essentially the same idea posed in the introduction of a recent Australian text on genetic resources of forage plants (McIvor and Bray 1983).

Where sufficient information on the genetic relationships of the various species and biotypes of a group of species has been developed, a more ambitious program of genetic improvement is possible using modern plant breeding techniques to create hybrids of superior individuals. The best example is the research and development program by Douglas Dewey and his colleagues of the USDA Agricultural Research Service forage group at Logan, Utah, who have worked on the related genera and species of wheatgrasses. Results from recent research by K.H. Asay (personal communication, 1985) show the superiority of new cultivars of crested wheatgrass and Russian wildrye. "Hycrest," a tetraploid hybrid between standard Fairway crested wheatgrass and standard crested wheatgrass, grown in five locations in the Intermountain region showed significantly greater establishment and yield than crested wheatgrass cultivars Nordan and standard Fairway, as well as the Russian wildrye cultivars Boz-Sel and Vinal (Table 1).

Where a unique plant genotype has been identified, it may be desirable to reproduce that type without losing its genetic features through regular reproduction from seed. A tiny piece of the stem tip can be induced to grow in vitro (Torrey 1985) on a medium containing a balanced formula of growth hormones, nutrients, and an energy source under sterile conditions (Murashige 1974). Called Mericlone regeneration, this technique is now commonly used to propagate many unique plants and to serve as a tool for the plant breeder. Systems for producing many species have been developed even though each species and biotype requires a special combination of growth-promoting hormones to elicit differentiation and growth responses (Bhojwani and Razdan 1983). Where cost is not a major constraint, large numbers of genetically identical plants can be produced in vitro for direct planting. If seeds are required, one or more superior genotypes can be produced by tissue culture and planted in a seed orchard to intercross naturally and produce seeds of a better character than those of the diverse original population.

Table 1. Forage yield of crested wheatgrass and Russian wildrye cultivars on five range sites during stand establishment (Yr-1) and subsequent seasons (Yr-2 and Yr-3). (Asay, personal communication, 1985)

Cultivar	Location									
	Decker, Mt.		Blue Creek		Lakeside		Thiokol		Malta, Id.	
	Yr-1	Yr-2	Yr-1	Yr-2	Yr-2	Yr-3	Yr-2	Yr-3	Yr-2	Yr-3
	kg/ha									
Hycrest	4090	2030	1340	2560	2610	2050	3950	2670	2510	1400
Nordan	3790	1640	480	2060	1550	1500	2430	1950	1740	1120
Fairway	3630	1700	630	1780	960	1410	3170	----	----	----
Boz-Sel	1190	840	410	1370	860	1610	2530	2030	1660	1100
Vinall	820	470	450	1430	280	820	1270	1370	1080	720
$LSD_{(0.05)}$	550	560	120	610	390	250	830	470	500	410

When somatic tissues are grown in vitro and are cultured as callus, natural mutations or variants appear in the regenerated plants in frequencies sufficient to be useful as a tool in plant breeding and as a source of new characteristics. Inasmuch as the observed variability occurs at random, not all variants have a positive value. However, if sufficient numbers of plants are regenerated, the chances for useful variants increases. Questions have been raised as to the stability of the variants. If vegetative reproduction is intended, the issue of stability is not as great as if reproduction by seed is necessary. Much depends on the type of variability and the species involved. Tischler et al. (1985) state that tissue-culture-induced variability appears to be transmitted intact to progeny of apomictic dallisgrass (Paspalum dilatatum).

Somaclonal variants produced in vitro can be screened for tolerance to a stress incorporated in the medium. Nabors (1985) has screened sodium-chloride-tolerant variants of oats and rice that are stable in both callus and whole plants. Wurtele et al. (1985) have increased the salt tolerance of Atriplex caniscens explants in a system of regeneration in a high salt medium. Tolerance to other stresses such as drought, disease, and herbicides can be screened and developed in the tissue culture medium.

Another means of using tissue culture techniques for plant improvement is to use chemical mutagens to create variants from which to make selections capable of superior performance. Colchicine, azide, and other mutagens have been used as a topical application to plant tissues in vitro. Some encouraging results have been obtained with somatic variants of willow by Steve Garton (NPI Co., Salt Lake City, Ut., personal communication, 1985). The problems of stability may be the same as with other somatic variants. However, the potential for obtaining new variants with this technique appears to be very promising (Larkin and Scowcroft 1983).

Protoplast manipulation and fusion to form somatic hybrids is another adaptation of tissue culture techniques. By adding pectinase and cellulase to a cell suspension culture, cell walls can be dissolved, thus preparing the way for the naked cells, or protoplasts to be induced to fuse.

Polyethylene glycol as well as an electric current (Wallin et al. 1974) have been successfully used to induce protoplast fusion. Early success has been obtained with the fusion of cells from similar genetic types to create increased levels of ploidy (Larkin and Scowcroft 1983). Problems with somatic compatibility appear to reduce the chances for wide genetic hybrids (Harms 1983), although a number of experimental successes at the cellular level have been reported.

In vitro anther culture has been successfully used to provide haploid cells for genetic experimentation. According to reports from the Chinese Institute of Genetics (Hu, personal communication, 1984) haploid plants of several species such as sugarcane, wheat, rubber, and lily have been regenerated. Doubling of the chromosomes of regenerated haploid plants would provide a completely homozygous plant for use in genetic improvement programs.

Longer term research using recombinant DNA techniques offers the greatest promise for plant improvement. Currently, restriction fragment polymorphism DNA mapping appears to be useful in assessing plant diversity and guiding the selection of optimum parents for genetic crosses (Helentjaris et al. 1985). With appropriate information concerning the loci of DNA controlling key characters, plant breeders will be able to follow genetic inheritance ratios more closely and in less time (Nienhuis et al. 1985).

DNA transfer of novel characteristics to desired plants is the most difficult goal of biotechnology. Current research seeks to transfer DNA for the expression of stress resistance, herbicide resistance, disease resistance, production of natural insecticides, growth increase, production of secondary metabolic compounds, and nitrogen fixation, to list a few of the most interesting (Caplan et al. 1983). Progress in developing techniques for the transfer of cloned DNA to desired species is considerably enhanced by success in using a Ti Plasmid from Agrobacterium tumefaciens as a vector (Kosuge et al. 1983). Success in DNA transfer depends on advances in gene isolation, analysis of gene control and expression, and improvement of tissue culture techniques such as cell regeneration. To be successful, biotechnology must coordinate all of the appropriate research activities as well as provide a continuum from research to production.

Improved soil-plant relations

Improvement of soil fertility and plant survival may be possible by using selections of superior mycorrhizal fungi and nitrogen-fixing bacteria. Wood (1984) described how the productivity of marginal lands and disturbed soils can be improved by inoculating plants with superior strains of soil microorganisms. Call and McKell (1985) showed a positive influence in field establishment of fourwing saltbush in processed oil shale and disturbed soil by inoculating seedling transplants with VA mycorrhizae. The beneficial influence was shown to be the result of increased phosphorus uptake plus a more favorable soil moisture withdrawal. As this area of research matures we may expect to see superior strains of inoculants for shrubs, grasses, and forbs, especially legumes, developed for rangeland and other stress environments. In addition to expected improvement of rhizobium bacteria, research is underway to transfer genes controlling nitrogen fixation to nonlegumes, including trees and shrubs. Other strategies involving nitrogen-fixing organisms will include transfer of genetic controls for the elaboration and release of natural pesticides by the roots or associated microorganisms.

Biological pesticides

Many plants have avoided damage from insect pests by evolving natural strategies that include the elaboration of secondary chemical products of metabolism. Even in small amounts these chemicals are often potent to certain insects but not to humans. Kubo and Klocke (1982) extracted a chemical, azadirachtin, from the Neem (Azadirachta indica) tree of India. Subsequent studies have shown that azadirachtin affects the production of chitin, essential in the formation of insect exoskeleton, and thus is a safe means for controlling insects that go through ecdysis, or moulting stages. From the many secondary compounds produced in plants, future opportunities to develop biological pesticides look very

bright. Range shrubs, forbs, and grasses are extremely varied as hosts to insect pests and may be the source of many useful biological pesticides.

New plant products

New plant products for industrial use have been identified from native species adapted to arid and semiarid rangelands. Study committees of the National Academy of Sciences (1975, 1985) point to the opportunities for new uses of range plants that would bring additional revenues and possibilities for multiple use. Using techniques from biotechnology, superior strains of jojoba and of Atriplex spp. have been produced in tissue culture for field production. One of the key points discussed in various papers presented at the International Conference on Arid Lands at the University of Arizona in October 1985 was the need for identification and availability of superior plant materials that are adapted to the stresses of arid environments and produce at an economic level (Off. Arid Lands Stud. 1985).

Incentives for the Future

If given the proper incentives, biotechnology has the potential to provide some extremely useful products for rangeland applications. Whereas bioscience research must focus on high-reward opportunities in high-intensity agriculture (Comm. on Biosci. Res. in Agric. 1985), rangeland vegetation may also be selectively targeted for improvement. All of the potential of genetic engineering, cell biology, microbiology, genetics, and biochemistry may be applied to the improvement of range plants and enhancement of ecosystem processes. A host of biological opportunities are already identified and only require the attention and financial commitment to make them a reality.

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PEST RISK MANAGEMENT

By John R. Wood[1]

Range pests, whether they be insects, noxious plants, disease organisms, or vertebrate animals, are an integral part of the total environment. The millions of organisms in this environment through the years have adjusted to a reasonable state of coexistence. However, today we have a greatly altered environment with greater interaction between the rangeland, man, and other animals. One of the most important and most complex problems of this interaction is dealing with the pests that compete with man for use of domestic animals (Kearl 1980). Review of the literature since 1966 shows that the challenge of pest control by chemical, biological, genetic, and physical means still remains as complex today as it was then, even with the development of more sophisticated techniques. (Am. Assoc. Adv. Sci. 1966; Natl. Res. Counc. 1966, 1969; Kilgore and Doutt 1968.)

The implementation of pest control programs is complex also, considering that it involves four parties: (1) the agents of pest control; (2) the managers of the pest-affected production system; (3) the consumers of the goods produced by the pest-affected system; and (4) a fourth party, comprising the people whose welfare is affected by pest control, and who may belong to none of the three other groups. Specific interests of each party may conflict and, whenever possible, strategies of pest management should be developed and adopted by the explicit consensus of all parties, as a matter of practicality (Geier 1982).

But consensus is difficult because of the diverse users of these rangelands. One immediately thinks of ranch operators using grazing lands, the outdoor recreationists using public lands for several purposes, the oil and mining companies extracting minerals, and logging companies harvesting timber. All consumers are affected to some degree and indirectly are users of the publi lands.

The difficulty of consensus is apparent from responses to the 47 federal laws that affect the management of lands controlled by the U.S. Department of Agriculture's (USDA's) Forest Service and the U.S. Department of the Interior's (USDI's) Bureau of Land Management (BLM). Court cases or court decrees have stemmed from or been associated with these laws. A great number of regulations have been promulgated and administrative guidelines and handbooks written o revised to implement the instructions in the regulations stemming from all these laws. The legislation, regulations, and at least one or mor court decrees have had a serious impact on the pest management actions on federal lands. Many pest management programs in animal agriculture or rangelands have been curtailed or stopped because of advocate reactions that were based on these same laws. One basis for the opposition has beer the purported damage or risk to the environment (Kearl 1980).

Pest-control scientists and technologists have ignored or dodged consensus of all involved parties, apparently for two reasons: (1) they have been trained not to think seriously beyond the "nut and bolt" issues of their discipline, ar (2) they felt no pressing need until recently to look further into this complex problem.

BLM has used a number of different procedures in socio-economic sections of grazing rangelands. They are collecting basic range data and using that data to construct activity budgets for linea programming. The Environmental Protection Agenc (EPA), USDA, USDI, and state universities have spent literally millions of dollars on alternati concepts to control pests, yet the situation ten to be more complex today than yesterday. For example, EPA and the staff of USDI's Western Energy and Land Use Team (WELUT), spent 3 years working on the concept of adaptive environmental assessment for integrated pest control in agroecosystems but did not provide for applicati of the concept (EPA 1982).

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The U.S. public agricultural research system has played a major role in increasing this nation's rangeland productivity. According to a recent study (Feller 1984), this system has traditionally been commodity directed, and despite current trends toward interdisciplinary thrusts like integrated pest management and integrated production management the system remains commodity related. With a new plan, the Agricultural Research Service (ARS) is trying to establish its basic research orientation. For livestock the report on the plan states "As described in crop production, we have reached the limits in many instances, and further progress requires research ranging from fundamental studies of intricate life processes to the development of totally new ways to increase efficiency and productivity" (Feller 1984).

It appears that USDA's primary responsibility is in areas such as plant quarantine and animal disease when the threat is from areas outside the country, the national interest is evident, and neither states nor private industry have responsibility. The definition of the terms "basic and applied research" also constitutes a perennial, practical problem (Feller 1984).

We can no longer regard pest control as a simple technique or production like any other process whereby straightforward causes are simply related to immediate effects. Pest control must be conceived and practiced in the three dimensions of biology, technology, and socio-economic aspects (which represents the relationship among the people involved in pest control) (Geier 1982).

These factors do not operate in isolation as separate entities. Very often two or more of these factors combine to promote their interests at the expense of the others. We can no longer work in isolation in pest management, but should look at maintaining the operability of rangeland for all concerned through the use of risk management. Pest risk management, in the context of this discussion, involves the development of procedures, techniques, and models designed to be used by operating managers to (1) determine the optimal strategies for coping with pest damage, (2) quantify the effects of various control strategies on populations of the target and nontarget species, and (3) locate the best sites for pest management (Edens 1976).

The exact nature of pest risk management is critically dependent upon the availability of input parameters and coefficients that truly represent the conditions in the field. Key parameters include density-dependent mortality/natality for target and nontarget species, competitive/predative strength coefficients, pest abundance, and habitat and food preference. In addition, an interactive query system is required to focus on the environmental and operational units parameters, such as compliance with laws and regulations and survival of the operational unit (McKenzie et al. 1982).

The technology is here. For the researcher and technologist the goal should be to bring that technology from the research phase to application.

The Office of Technology Assessment has defined integrated pest management as ". . . the optimization of pest control in an economically and ecologically sound manner accomplished by the coordinated use of multiple tactics to assure stable crop production and to maintain pest damage below the economic injury level while minimizing hazards to humans, animals, plants, and the environment" (Dover 1985). This statement also reflects the goals of range management for livestock production, which are to ensure optimum yield of the products sought from rangeland, stable watersheds, clear water, wildlife, amenities, and food and fiber. In the production of livestock, the range manager must seek to obtain the most efficient transfer of energy from the forage to animals eaten by man. Successful production of livestock depends upon careful handling of both forage and animals and upon the greatest harmony between the two. Livestock producers must be concerned with the animals, and the range managers must not concern themselves only with the range at the expense of the animals (Stoddard et al. 1975).

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RANGELAND RESEARCH AND TECHNOLOGY AS RELATED TO PLANT SPECIES

By Jim B. Grumbles[1]

The plant species composition of a given area of rangeland at any time is a product of the various environmental parameters, including man, that are being imposed upon it. The desirability of the existing species composition depends upon who has control of the land, either through private ownership or via mandate such as the Multiple Use Act of 1963. The land use under private ownership is, for the most part, at the discretion of the owner, whereas the Multiple Use Act requires by law that lands under the control of the U.S. Department of Agriculture's (USDA's) Forest Service be managed for forestry, livestock, wildlife, watershed, and/or recreation or preferably a suitable combination thereof.

Therefore, a discussion of rangeland research and technology as related to plant species involves at least two schools of thought. First, does the existing species composition meet the desires of the individual, agency or other controlling party? If so, then a management plan designed to not only utilize but also maintain the land resource in its existing condition is paramount. However, it should be reiterated that the use of a given piece of landscape must be "in tune" with the environmental parameters imposed and "proper use" may not be the same as "desired use" of that particular area.

Second, if a change in the existing species composition is required to meet the desires of the managing entity, then thought must be given to plant species manipulation. More often than not, some modification of composition is needed in order to reap the highest and most effective use of the rangeland resource.

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Methods of Species Manipulation

Mechanical

The bulldozer, the rootplow with and without the rootrake, and chaining are examples of technology developed many years ago that is still in use on rangelands today. The most noticeable change in the use of this equipment is that today it is being used primarily on areas of highest production potential.

Research relative to mechanical methods of plant species modification is being directed toward equipment such as the low energy grubber (Weidemann et al. 1977) to be used for maintenance control of reinvading undesirable species. Anchor chains (Weidemann and Cross 1985) are being designed not only to remove live as well as dead woody vegetation but also to prepare a seedbed for aerial reseeding of desired plant species(Weidemann 1985).

The use of these mechanical methods is almost universally in concert with other methods to be discussed and since the selected areas are most often areas of high production potential, seeding with adapted plant species is a common practice. Long-standing plant species research by the USDA plant materials centers has made strong contributions by providing adapted native or introduced plant species for improvement of the rangeland resource (Dr. Thomas Shiflet, director, Midwest National Technical Center, Soil Conservation Service, personal communication).

Chemical

The use of chemicals for the control of undesirable annual and perennial herbaceous plants (weeds) has become an accepted and more widely used practice in recent years. A weed is defined as a "plant out of place." However, a weed may be an esthetic beauty (wild flowers) to some who view the rangelands, forage for livestock and wildlife to others, and a definitely unwanted plant to still others. Such being the case, it is imperative that a decision relative to the desired herbaceous composition be made prior to the use of chemical methods, which are certain to modify the

species composition at least during the year of application.

The chemical control of undesirable woody vegetation has been an accepted practice since the advent of 2,4,5-T in the late 1940's and early 1950's for the control of mesquite, oak, and many other brush species. This product is no longer commercially available for these uses.

Research initiated in the early 1960's by the Dow Chemical Company provided a new compound called picloram, which was found to be effective alone on some species but was very synergistic when used in a 1:1 combination with 2,4,5-T on mesquite, oak, and other species (TORDON[2] 225 - no longer available). Further investigation by the Texas Agricultural Experiment Station in the late 1960's and early 1970's produced another brush herbicide called dicamba (Banvel[3]) which was also used in combination with 2,4,5-T on mesquite.

Other research efforts in the early 1970's produced tebuthiuron (Graslan[4]), which was shown to have excellent activity on the various oak brush species. This chemical was also recommended for use on the mixed brush species of south Texas, especially whitebrush. The original label was written for aerial application only and rescinded by Elanco in mid-1985. The label has been revised to include other methods of application. A label approval by the EPA is expected in the first quarter of 1986, and when available, the product can be purchased over the counter and applied via air or ground.

Research efforts beginning in the mid-1970's and continuing to date have investigated the activity of some new compounds as follows:

o Dow Chemical USA:

1984 -- Triclopyr = [(3,5,6-trichloro-2-pyridinyl) oxy] acetic acid.
GRAZON[5] ET = registered in 1985 for use alone or in combination with picloram on mesquite in Texas, Oklahoma, New Mexico, and Arizona.

1974 -- Clopyralid = (3,6 - dichloropicolinic acid).
LONTREL[5] = clopyralid alone, 3 lbs ae/gal.
GRAZON[5] P+L = picloram + Lontrel herbicide, 1.5 + 1.5 lbs, respectively, ae/gal formulation. Experimental Use Permit in 1984 and 1985; rangeland registration forthcoming.

1982 -- All herbicide formulations sold by Do Chemical USA for use on rangelands in the southwest were registered under the new trademark GRAZON and include GRAZON PC (picloram concentrate); P+D (picloram + 2,4-D); 10K (10% active clay pellet): and ET (ester of triclopyr).

o E.I. DuPont de Nemours & Co.:

1979 -- Hexazinone (Velpar[6] L registered as a spot-on individual plant treatment on rangelands in 1983).

Plant physiology in relation to its impact on chemical efficacy is being studied by researchers at the Texas Agricultural Experiment Station at Vernon in north Texas (P. W. Jacoby and R. J. Ansley, Texas Agricultural Experiment Station, Vernon, Texas, personal communication, 1985). Ke physiological factors are being studied to determine where, when, and under what

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2/ Trademark of The Dow Chemical Company.
3/ Trademark of The Velsicol Company
4/ Trademark of The Elanco Products Company

5/ Trademark of The Dow Chemical Company
6/ Trademark of E.I. DuPont de Nemours & Company

environmental conditions a mesquite tree utilizes water. Seasonal and diurnal leaf transpiration patterns as well as the dynamics of root growth and distribution are being measured on individual trees under field conditions. Knowledge of these parameters could lead to more effective timing of foliar application of liquid herbicides used for brush control.

Chemical application technology. Recently developed technology now provides for computer-controlled chemical injection (no tank mixing) of herbicide formulations directly from the original container into the spray system. Calibration for rate is also computer controlled, whereby true ground speed is submitted to the computer from a magnetic sensor or from a radar unit. If ground speed varies, the rate of chemical being injected varies accordingly. Upon completion of the spray project, the computer is inactivated, chemical injection ceases, and clear water is pumped through the system. This means no rinsate or herbicide waste to be disposed of following application (G. Gebheim, Ag Robotics, Childress, Texas, personal communication, 1985). This technology is fully functional on ground equipment and work is in progress to adapt it to aircraft. Eventually, the same groundspeed indicator system (probably radar) will send signals to a computer, which will control the application rates of either liquid or dry herbicides. Positive metering equipment (electrically driven veined rotor) is now available for all types of fixed-wing aircraft for applying dry formulations of either herbicide or insecticides (Jack Duke, Mid South Aerial Application Service, Tuscaloosa, Alabama, personal communication).

Prescribed burning

Research conducted at the Texas Agricultural Experiment Station at San Angelo in west-central Texas indicates that burning pricklypear (pad) cactus prior to herbicide application increases plant kill (D. Ueckert, Texas Agricultural Experiment Station, San Angelo, Texas, personal communication, 1985). Burns in February followed by broadcast applications of 0.125 lb ae/acre of picloram provided 90+ percent plant kill and faster plant kill than 0.25 lb ae/acre of picloram without burning. Prescribe burning is a good management tool when properly incorporated into the overall management scheme.

Integrated brush management systems

"Integrated Brush Management Systems" (IBMS) was coined by researchers in the Range Science Department at Texas A&M University and is the title of a June 1985 publication (Scifres et al. 1985) covering the subject. The IBMS approach essentially involves organizing information from the entire array of range resource management activities that relate to brush management.

Summary

Our ecosystem is dynamic, whether managed by man or nature. It is important that we manage it properly. In summary, there is risk involved in vegetation management; the name itself implies risk. The integration of vegetation management practices has an inherent risk factor. But the biggest risk of all is doing nothing, and our future generations would suffer greatest from that practice.

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WILDLIFE HABITAT RESEARCH ON RANGELAND: A NEW PERSPECTIVE

By Timothy E. Fulbright and Samuel L. Beasom[1]

Wildlife habitat management will be a higher priority in the future than in the past for range managers because of increased demand for improved wildlife habitat on public lands and growth in importance of commercial hunting in Texas and other range states. Indeed, income from commercial hunting exceeds income from livestock for many Texas ranchers, and fee hunting is becoming firmly entrenched in other areas. Tresspass fees of up to $10 per acre for hunting are common in south Texas, and landowners in the state earn $80 million to $100 million annually from this resource (Guynn 1984). Given that the demand for beef at the market place is projected to decline for at least the immediate future, wildlife-derived income may influence the very existence of many ranches as we know them today. Therefore, wildlife habitat research also will gain in priority. Since brush management and grazing management are the primary influences on wildlife habitat on rangeland, much research attention will be focused thereon.

Wildlife habitat research on rangeland has primarily been concerned with 1) improving range for wildlife and 2) evaluating effects of grazing and range improvement (primarily brush management) for livestock on wildlife habitat. At the request of the conference organizers this discusssion will focus on examples on Texas rangeland where wildlife is economically competitive with other natural resources.

Range Improvement for Wildlife

Management practices that improve wildlife habitat include discing rangeland and shredding mature brush. Webb and Guthery (1983) found that spring discing of honey mesquite (Prosopis glandulosa) rangeland in northwest Texas increased abundance of wildlife food plants. Everitt (1983) reported that following shredding the regrowth of four species of deer browse in south Texas had higher crude protein and phosphorus levels than mature growth for at least 2 months after treatment.

Progress in developing wildlife food plants for planting on rangeland also is being made. The plant materials center run by the U.S. Department of Agriculture's Soil Conservation Service (USDA-SCS) at Knox City, Texas, has released 'Rainbow' wild plum (Prunus spp.), 'Aztec' Maximilian sunflower (Helianthus maximiliani), and 'Sabine' Illinois bundleflower (Desmanthus illinoensis), all of which have value for wildlife. Several native plants are under evaluation at the SCS South Texas Plant Materials Center at Kingsville, Texas, for wildlife plantings. Notable among these are least snoutbean (Rhynchosia minima), velvet bundleflower (Desmanthus velutinus), and fourwing saltbush (Altriplex canescens).

Native plants used in wildlife plantings are often difficult to establish, but the senior author is conducting several studies on seed germination to improve this situation. Fulbright and Flenniken (unpubl. data) found mechanical scarification of showy menodora (Menodora longiflora) increased germination from 53 percent for controls to 81 percent for the test group. Germination of spiny hackberry (Celtis pallida, a valuable browse and fruit-producing plant for many species of wildlife including white-tailed deer (Odocoileus virginianus), wild turkey (Meleagris gallopavo), and bobwhite quail (Colinus virginiana), was increased from 1 percent for controls to 49 percent by scarification combined with 1.4 mmol liter^{-1} gibberellic acid, moist heat (3 days at 30 degrees C), and moist prechilling (2 weeks at 7 degrees C) (Fulbright et al., unpubl. data). Other current research by the senior author indicates that growth of containerized seedlings of spiny hackberry (Celtis pallida) can be increased dramatically by providing shade and spraying seedlings with a solution containing gibberellic acid after they are transplanted into the field.

1/ Associate professor and director, respectively, Caesar Kleberg Wildlife Research Institute, Texas A&I University, Kingsville, Texas.

Effects of Grazing on Wildlife Habitat

Grazing by domestic livestock is the major anthropic factor affecting wildlife habitat on rangelands. Holechek et al. (1982) discussed how grazing strategies can be altered to variously affect wildlife habitat. F. S. Guthery (Caesar Kleberg Wildlife Research Institute, personal communication) has found that ranges in high range condition east of the 76-cm isohyet can be improved for bobwhite quail by grazing heavily enough to increase abundance of low successional plant species and bare ground. However, heavy grazing by domestic livestock can reduce habitat quality for some wildlife. Warren and Krysl (1983) concluded that grazing must be controlled to maintain a high nutritional status in white-tailed deer on central Texas rangelands.

Research concerning impacts of specialized grazing systems on wildlife habitat is needed. Bryant et al. (1981) found by simulating diets that white-tailed deer receive more crude protein and phosphorus on rangeland grazed under the Merrill four-pasture, three-herd system than on continuously grazed range. Short-duration grazing appears not to harm nesting habitats of bobwhite quail or wild turkey. Bareiss et al. (1986) found coverage, density, and dispersion of nesting cover for bobwhites and turkeys were similar under short duration and continuous grazing.

Effects of Brush Management for Livestock on Wildlife Habitat

Brush provides both food and cover for wildlife. Effects of brush management on game animals such as white-tailed deer are of particular concern in south Texas because of the large income derived by landowners from commercial hunting. A diversity of palatable browse species is important for quality deer habitat. Several studies have shown that white-tailed deer prefer forbs over browse when forbs are available (Chamrad et al. 1979). Studies by Arnold and Drawe (1979) and Meyer et al. (1984) show, however, that browse is the major component of deer diets in summer, fall, and early winter or during drought periods when forbs are less available. Those authors also found that browse is an important component of deer diets even during seasons when forb consumption is highest.

The brush management technique used and the type of brush subjected to management are important in terms of food relationships. That the different techniques used have differing vegetative impacts is obvious. However, the response of wildlife to treatment of different vegetative types is less clear. Inglis and McMahan (1974) reported that white-tailed deer do not discriminate between brush types used for cover, but Beasom et al. (in press) showed that these animals use certain brush complexes much more than others. Whether the disproportionate use was related to food or some other factor is relatively unimportant. Of paramount importance is that the animals do favor some bush complexes over others. Therefore, where deer are an important resource, brush management should be considerate of pretreatment vegetative composition, and treatments should be limited to areas of least utility to the animals.

Effects of mechanical brush management

Mechanical brush management can drastically alter wildlife habitat. White-tailed deer show limited use of rangeland where large tracts of brush have been cleared by root plowing or other methods (Beasom and Scifres 1977, Scifres 1980). Brushy areas should be left following mechanical brush management to meet cover and browse requirements of deer. In south Texas, brush is often treated in strips or other patterns to maintain deer populations. Research by Steuter and Wright (1980) and Wiggers and Beasom (1986) indicated that brush canopy cover should be a minimum of 60 percent for maximum white-tailed deer populations. For mule deer (Odocoileus hemionus) in western Texas, however, Wiggers and Beasom found that brush canopy cover exceeding 40 percent resulted in population reductions. The amount of brush that should remain untreated probably varies with such factors as species composition and pretreatment density, but these have not been evaluated.

Brush usually resprouts and/or reinvades following mechanical management. Time required for return of brush varies with the treatment and moisture

mortality to prickly-pear (Opuntia spp.), a preferred food for these animals (Beasom and Scifres 1977).

The senior author is studying the effects of tebuthiuron, N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl)]-N,N'-dimethylurea, application on white-tailed deer nutrition and diet composition. Tebuthiuron was aerially applied in strips (50 percent coverage) to about 260 ha of live oak (Quercus virginiana) dominated rangeland in 1982. Track count data taken in 1985 indicate that treatment with tebuthiuron did not reduce deer use of the treated area relative to a control area. Crude protein content of deer diets tended to be higher on the treated area than on the control the third year after treatment, although the difference was not statistically significant ($P > 0.05$). Three years after treatment, forb production and grass production were 5.0 and 3.5 times higher, respectively, in treated strips than in untreated strips.

Effects of fire

Fire can improve wildlife habitat in certain areas. In particular, fire can be used to increase forb production and diversity, thereby enhancing the quality or quantity of the food supply for many wildlife species.

Springer et al. (unpubl. data) found repeated burning of "thicketized" live oak savannah over a 10-year period increased forb standing crop and diversity. Season of burning is an important factor that affects forb response to fire. Springer (1978) reported that fall burns increased forb production on live oak savannah, whereas spring burns disproportionately favored grasses.

Future Implications of Wildlife Habitat Research for Range Management

Improved methods of wildlife habitat management on rangeland should benefit livestock as well as wildlife. Planting forbs for wildlife in range seeding mixtures or in food plots probably will improve range livestock nutrition. Cook (1983) pointed out the importance of forbs for livestock. Brush management strategies that favor wildlife may also favor livestock. Browse is sometimes an important part of cattle diets on south Texas ranges, especially during the summer when the nutritional value of grasses is low. For example, Davis (1952) reported that browse composed 30 percent of cattle diets on the Norias Division of the King Ranch in July during a drought year.

It is time for some "new think" in range management. Indiscriminant removal of brush for the sole purpose of increasing herbaceous forage for livestock is 1) incompatible with the definition of range management, 2) of dubious economic justification, and 3) of unsound ecological conscience. Until we accept the idea that we are managing rangeland for our great grandchildren instead of ourselves, we in the profession are not attending to our responsibility of stewardship. Furthermore, conducting indiscriminant removal under the "license" of range improvement may be questionable in the eyes of the public. Our research on long-term responses of brush to various types of control practices demonstrates that after 50 years it is difficult to see the "improvement" rendered by some range improvement practices.

There is a need to put into action the brush "management" philosophy so eloquently espoused by Charles J. Scifres several years ago in his book "Brush Management" rather than the "eradication" or "control" philosophies which no longer are sound. Management technology should include some of the positive aspects of brush and other habitat components. Indeed, perhaps we should usher in a new perspective and call it "brush conservation." This term connotes the wise use that was intended by the management perspective and certainly is compatible with the definition of range management. Future research should be focused on economic aspects of brush such as power generation, charcoal for cooking, wood for home heating, and habitat restoration for wildlife.

Similarly, there is room for novel thinking regarding grazing practices. As has been pointed out by several speakers before me, the livestock industry does not currently need new strategies to permit stocking with more animals--their current

conditions. Areas chained one-way in south Texas may require retreatment after only 2 to 3 years, whereas root-plowed areas have an expected life span of 10 to 20 years. Brush communities that reestablish following mechanical brush management may differ considerably, however, from the original communities.

In 1984 and 1985 the authors compared brush densities on untreated rangeland in La Salle County, Texas, to densities on adjacent areas that were root plowed between 1955 and 1959 or roller chopped between 1953 and 1955. Included in the study were honey mesquite (Prosopis glandulosa), twisted acacia (Acacia tortuosa), and four browse plants important for white-tailed deer--coma (Bumelia celastrina), spiny hackberry (Celtis pallida), bluewood (Condalia obovata), and guayacan (Porlieria angustifolia). On root-plowed and adjacent untreated areas the plant density (plants ha^{-1}) was as follows:

Brush species	Treatment	
	Untreated	Root Plowed
Twisted acacia	120	635
Coma	370	52
Spiny hackberry	912	127
Bluewood	34	0
Guayacan	789	37
Honey mesquite	605	1865

Honey mesquite density averaged 3 times greater on root-plowed areas than on untreated areas. Twisted acacia was also present in greater densities on root-plowed areas. Woody plants valuable as browse for white-tailed deer were present in lower densities on root-plowed areas than on untreated areas. Density of guayacan, a highly preferred browse plant, averaged over 20 times greater on untreated areas than on root-plowed areas. Untreated areas supported 41 percent more brush species than root-plowed areas. Our results suggest that ranchers in southwest Texas should consider methods other than root plowing if clearing of large areas is planned and if they wish to maintain quality habitat for white-tailed deer.

On roller-chopped and adjacent untreated areas the plant density (plants ha^{-1}) was as follows:

Brush species	Treatment	
	Untreated	Roller Chopped
Twisted acacia	101	157
Coma	320	22
Spiny hackberry	746	1054
Bluewood	6	22
Guayacan	1301	3162
Honey mesquite	734	2512

Densities of many browse species were similar on roller-chopped areas and adjacent untreated areas. However, honey mesquite and guayacan, respectively, averaged 3.4 and 2.4 times higher on roller-chopped areas than on untreated areas. Densities of most valuable browse species were not reduced greatly by roller chopping. The roller-chopped and untreated areas contained similar numbers of woody plant species.

Effects of chemical brush management

Treatment with herbicides can improve forage production for livestock, and habitat quality for game species such as white-tailed deer can be maintained or improved if sufficient untreated brush is left. White-tailed deer populations are not adversely affected by application of 2,4,5-T + picloram to 80 percent of mesquite-mixed brush rangeland (Beasom and Scifres 1977, Tanner et al. 1978, Beasom et al. 1982). Deer numbers are reduced immediately after treatment but return to levels equal to that on untreated range once forb production and diversity on treated areas recovers (Beasom and Scifres 1977, Tanner et al. 1978). Beasom and Scifres (1977) found that treating 80 percent of mesquite-mixed brush rangeland with 2,4,5-T + Picloram did not adversely affect nilgai antelope (Boselaphus tragocamelus), wild turkey, and feral hog (Sus scrofa) populations. Complete treatment (100 percent sprayed) reduced populations of all wildlife species evaluated except nilgai antelope. Populations of javelina (Pecari tajacu) were reduced by both 80 percent and 100 percent treatment, apparently because of high

mortality to prickly-pear (Opuntia spp.), a preferred food for these animals (Beasom and Scifres 1977).

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Similarly, there is room for novel thinking regarding grazing practices. As has been pointed out by several speakers before me, the livestock industry does not currently need new strategies to permit stocking with more animals--their current

economic dilemma does not stem from too few animals. What is needed is the development of grazing management strategies which will improve economic returns from other rangeland resources (e.g., wildlife). Hopefully these philosophies, which already are gaining momentum, will guide us through coming decades.

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RESEARCH AND TECHNOLOGY: THEIR IMPLICATIONS FOR RANGE MANAGEMENT IN THE FUTURE

By Don D. Dwyer[1]

A major goal of agricultural research is to increase productivity of agricultural commodities. Most observers acknowledge that research in agriculture over the past 100 years is the reason American agriculture has been so productive. Research, its conduct and support, is the main avenue for increasing productivity from rangeland and the livestock it produces. We know that. Our examples are clear. They are just not abundant enough. The main reason the examples are too few is that not enough ranchers have chosen to apply what is already known. Some people ask why we should be talking about more research if we now know more than is being applied. It seems irrational to argue for more studies intended to increase food production when we already have so much food that farmers and ranchers cannot make enough money on the products to meet costs of production. In many cases I have to say "thank goodness" the research was not adopted by ranchers. What was recommended from the research was not cost effective, or not efficient, or both.

We should appeal for research that will make production more efficient, thus less costly. Events of the past several months have made it clear to virtually everyone that the agriculturalist is hurting and that if changes don't occur rather soon, agriculture as we have known it will disappear.

In a setting where food is abundant and cheap and where the producers of that food are failing because it is abundant and cheap, what kind of research should be recommended? I feel our research from now on should fall into one of three categories--applied, basic, and adaptive.

1/ Executive director, Consortium for International Development, Tuscon, Arizona, and professor of range science, Utah State University, Logan, Utah.

Applied Research

In this category is the majority of today's ongoing research on such topics as vegetation management and control, range seeding, plant breeding and selection, grazing management, and stocking rate. Some efforts should continue to explore variations on these central themes, but emphasis should be reduced. Since about 1915, when organized and supported range management research commenced, researchers have concentrated on the obvious and general about the plants, animals, and soils. That effort was needed to teach us what we know now and to prepare us for the next step.

Basic Research

A great new initiative should be added to the portfolio of range research in fundamental aspects of plant and animal behavior and response. It is my view that the breakthroughs we need to have which will allow us to produce livestock products more efficiently from rangelands will come from basic research. Researchers must now move "inside" the range system and learn how individual plants react to stress, especially defoliation, competition, and drought. They must discover the physiological mechanisms that permit one species to survive and cause another to die.

Regarding livestock and their management, new research needs to provide ways to alter the animals' behavior. First we need to know why livestock eat what they eat, and then we must learn how to adjust that behavior to better suit production needs. Livestock, especially cattle, are extremely inefficient on the range. The only reason range livestock production is justified is that it utilizes a resource that little else can use and the resource renews itself annually at virtually no cost to the agriculturalist. The animal is released on a relatively vast area, goes where it wants, and eats what it wishes in an environment that is generally quite stressful. No wonder it's inefficient. Knowledge is needed which will allow greater control of the animal at very little extra cost to the producer.

cannot depend on high tech solutions to pull us through.

There are some fundamental, hard science questions that must be answered if we are to have breakthroughs in production at the ranch level, and these questions have to do with genetics, physiology, pathology, and nutritional behavior. Why do livestock eat what they eat, when they eat it? Why do they eat so few different plant species? What should the ideal range cow or sheep look like--inside and out? Why can't we have a cow or sheep that grazes what and where we want it to, always raises an offspring (maybe two), never gets sick, gains as efficiently as a chicken, and produces a product no one can get enough of?

The kind of research that needs to be done is costly. And, it must be acknowledged that integrated range - livestock production research has not been done much. The history of funding support for range and range livestock research has not been impressive. The deans of agriculture and the federal directors of agricultural research must be made aware of the needs in the ranching sector of agriculture. More funds are required, but research priorities must also be examined with the thought of reallocation.

It must be admitted that more of our present technology could be applied at the ranch level. The only ranchers now breaking even or better financially are those who are utilizing 70 to 80 percent of today's applicable technology. This includes recordkeeping, an absolute curse to a rancher, but an unqualified necessity to making money!

CAPITALIZING ON RANGE'S OPPORTUNITIES FOR THE FUTURE

SESSION CHAIRMAN'S REMARKS

By Dick Whetsell[1]

After three days of lectures, general statements and questions concerning "Opportunities for the Future" in range management, I feel that we are much like the poker player who placed his entire roll on the table and said, "I sure hope I can break even tonight because my wife sure needs this money." We cannot win by holding our position.

In this resource management game our goal cannot be to break even. We must win.

We have the necessary talent for a winning team. We have the people in our universities and Land grant colleges, state and federal extension agencies and experiment stations, and private industries. We have a large group of owners and operators who have been managing this resource for the past 100 to 200 years. So, we have plenty of science plus a group of ranchers who need the science and are ready for it.

What we do not have is a winning game plan. And that's the entire team's fault. Our information transfer has been slow and in some cases nonexistent. Our communication system has not functioned properly. Much of our technology is on the shelf and not on the land.

As we move into the 21st century, our rangelands will become more important for our food production chain and also for other uses. No doubt, in our future livestock programs, cattle will have to spend a higher percentage of their time on range forage to meet consumer demand for leaner meat. Cow-calf operations will increase. Larger numbers of heavy calves will go to lush pastures before feeding or directly to feed for a shorter finishing period, and they will be slaughtered young and tender with considerably less waste fat.

We must, therefore, make an honest and sound appraisal of our present position and attitude if we are to manage our range wisely and produce red meat that is acceptable to a health-oriented consumer.

To do this, we must candidly admit that the range we use and manage as a team has deteriorated from the first day it was fenced for domestic livestock use. There are knowledgeable people who observe that the decline is continuing even today. Similarly, the demand for red meat is declining. Consumption per capita is down and continues to decline.

Those of us who labor in the range-livestock environment don't have to guess what will happen to the range when sound ecological concepts are ignored. We have millions of acres of range that once was good but now is unproductive and in some cases covered with undesirable vegetation. Many products that were once popular have disappeared from the market place or have become very unprofitable.

So we have no choice. We must make the necessary changes in our game plan to guarantee that our ranges will remain healthy and will economically produce a red meat product that is also healthful. Pure water, wildlife, recreation, and red meat--all are products of the range and are essential to a quality life for all of our people.

1/ President and chief operating officer, Oklahoma Land and Cattle Company, Pawhuska, Oklahoma.

CAPITALIZING ON RANGE'S OPPORTUNITIES FOR THE FUTURE: A LIVESTOCK PRODUCER'S VIEWPOINT

By John B. Armstrong[1]

The livestock producer is the ultimate integrator in the utilization of the range resource. He must consider a total investment strategy that includes an assessment of the range resource at a given point in time; develop long-range objectives for management of the range resource; and develop a short- and long-range plan for livestock production that is compatible with his perception of the current and future market situation, cost of production, weather-related variables, and carrying capacity of the range resource. Increasingly, the livestock producer must also be concerned with wildlife as a source of income and profit; this resource must be factored into the overall game plan to achieve maximum income and profit. The livestock producer must be concerned about predators, noxious plants, and the potential impact of parasitism and disease on livestock and wildlife operations. It is in the total management context that the rancher must operate as he considers how to best use the range resource in the future.

It is at the risk of stating the obvious that I point out that profitability has to be a key if not overriding priority in managing the range resource; livestock operations have been unprofitable more often than profitable in the last 10 to 15 years. In very short run situations, such as might occur with short-term leaseholders, immediate profits might be bought at the expense of the range resource. However, in the more common case, the producer is motivated to seek the best compromise between short-term profit and long-term conservation and preservation of the soil, water, and other natural resources that sustain productivity and profitability. In the past, it has frequently been possible to compromise profit for the sake of the resource. In some cases, this is becoming much more difficult to do in the present crisis environment in agriculture.

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My assignment in this paper involves two parts. The first is to assess future opportunities on rangeland. The second is to express an opinion on how livestock producers can capitalize on these opportunities.

Rangeland is obviously a very large component of the natural resource base of this country. It constitutes 54 percent of the land area of the United States. While much of this resource has remained in a natural or unimproved state, a significant portion has been converted to improved rangelands, tame pastures, cultivated forages, and cropland. Much of the land area now used as range will not support other crop cultures. Thus, use of herbage from rangelands by livestock represents use of a renewable resource that otherwise would not be utilized for production of human food. Because the range resource is often found on marginal lands, management of this resource to avoid irreparable damage to fragile ecosystems is often challenging. In the developing countries as well as in some parts of the developed countries, mismanagement of these marginal lands is producing an alarming rate of desertification. In capitalizing on the use of rangeland in the future, we must reverse these trends and develop improved methods to profitably conduct livestock and wildlife operations on these lands without undue damage to the basic resource.

From the viewpoint of the producer, there are several exciting new opportunities emerging for the future use of the range resource in livestock production. The results of research and development are strongly directed towards helping the rancher as an integrator to put all the pieces together and do a better job of total management of the range-livestock-wildlife system. I mention wildlife as a part of the system because in many parts of the country, including South Texas where I live, wildlife and the recreational use of wildlife has become an important source of supplemental income for ranchers. As I look to the future use of the range resource, I believe we should learn more about how to maintain and enhance the wildlife resources in the context of a total production system. We need to know more about how to effectively produce wildlife and to use them for their recreational value.

Researchers are providing us with new methods of integrated management of noxious plants that consider the combined range-wildlife-livestock production system. Removal of brush to enhance forage production and reduce water loss should be done in ways that preserve the necessary cover for wildlife. The combination of prescribed burning and use of herbicides is reducing the cost of brush control to an economically tolerable level.

We are well along today in the development of new forage production systems that employ new forage species and various systems for rotation of livestock to give the best compromise between forage availability and long-term enhancement of the range resource. The factors that influence the behavior of the range resource under various combinations of rotation frequencies, weather, and stocking rates are being studied to give us the capability to understand the basis for making better decisions in managing the range resource.

Scientists tell me that we can expect to see major improvements in the performance of both livestock and forage species through the use of biotechnology. Such things as drought tolerance, disease resistance, and ability to fix nitrogen and more efficiently extract plant nutrients from the soil are all going to eventually be possible. Livestock species that use forage more efficiently, that are naturally resistant to pests and disease, and that have greater reproductive efficiency are also being developed through the addition of biotechnology to ongoing breeding programs. I also understand that scientists will develop a lean-beef production system that will make greater use of the range and pasture resources, with less time in the feedlot. The product will not only be lean but will also retain the flavor and tenderness demanded by consumers.

Remote sensing has considerable promise in allowing producers to capitalize on the use of the range resource, particularly in larger operations. The quality of both satellite and aerial imagery is getting far enough along to allow us to assess such things as brush cover, status of forage, population density of wildlife, and status of soil moisture. There is reason for concern, however, about the lack of progress in providing a system for analyzing and making available in near real time the information from such systems.

Agricultural operations, including the use of the range resource, have grown much more complicated in recent years. The computer has provided the means to deal effectively with a very broad array of technical information that should be considered in good management decisions today. There is also a mandate to keep abreast of current information, such as market and futures data and prices on various purchased goods. Thus, most effective management and decision systems will need to be computer based to give operators the best chance of capitalizing on the use of the range resource in the future.

How will livestock producers go about capitalizing on these new opportunities? If history teaches us anything, we can expect that the major benefits of this new technology will go to the early innovators--those who keep up with the cutting edge of science and technology and take first advantage of the new capability provided by research. The survivors in agriculture today will be the excellent managers, those who can use technology and good judgment to reduce cost of production, so they can remain competitive in the marketplace. I would expect to see more vertical integration of livestock operations in the future; this will make expanded use of the range resource more attractive as a low-cost way of attaining growth and gain in the production of lean beef. Water will continue to be a pacing item in all agricultural operations, particularly in the rangelands, which are mostly located in semiarid or arid regions. Brush control to generate both forage and water continue to be a critical part of the total strategy. The survivors in livestock operations will also have to do a much better job of risk management in the future than we have had to do in the past. Crisis avoidance, rather than crisis management will be needed.

Every good cowman knows it is much easier to anticipate what the herd will do and walk his horse over to the right place, rather than wait until the herd is going the wrong way and be forced to gallop to the point and intercede.

To capitalize on future opportunities, we will have to plan and think ahead about the total operation and try to keep our horses from getting into a big sweat by anticipating and avoiding problems that reduce profitability.

A CONSERVATIONIST'S VIEWPOINT ON RANGELANDS: WE CAN HAVE IT ALL

By Harold Salwasser[1]

Introduction

Most people involved in rangeland management, whether public or private, think of themselves as conservationists. But they have many views of what conservation means. To some it is maximizing the sustained production of a single resource, usually livestock forage. To others it is a balance of management practices designed to produce a mix of resources. To me, leaders such as Gifford Pinchot (1947) and Aldo Leopold (1966) captured the essence of conservation: conservation means stewardship of the diversity and productivity of lands and waters; the harmonious use of the land's resources for sustained yields of things people desire. This view of conservation is clearly a middle ground between exploitation of the land and preservation without use.

Conservation is, by nature, a balance between extremes. One often hears about achieving a "better balance" in the use of rangelands. It probably means that someone or some group wants to rearrange the current balance so that it addresses a different set of goals. In our dynamic society the specific goals for conservation change in response to changes in people's preferences, their sense of what is valuable, and their demands for new or different goods and services. That means the balance that is conservation is always in a state of flux. We have just passed through a period of great change in society's perception of conservation: the "environmental era" of the late 1960's to late 1970's. Now we are searching for ways to blend our concern for a high quality environment with economic sanity.

Perhaps the key question for rangeland conservation, maybe for conservation in general, is: How can we manage these lands for sustainable high productivity of their full diversity of benefits and not go broke in the process? The caveat on economics is valid for all of us, because no one, including govern- ments, can sustain anything for long if there is a constant drain on the bank account.

Allow me to propose some ideas as part of the answer to that question. They are not new. In fact, many of the papers in this volume address these ideas for change in greater detail. I am not sure that, taken singly, they would work. Their value is in their complementarity. They should be considered as integral parts of a new approach to conservation. One of the ideas comes from the environmental movement of the past two decades; another from the world of business; and the third from our everyday experiences in getting along with other people. In a nutshell, they are: (1) manage rangelands for their full diversity of resources and values, (2) use market systems to help determine the best balance of uses on rangelands, and (3) let the people who stand to gain or lose the most help chart the course of management and work out solutions to conflicts. Together these changes could go a long way toward improving rangeland conservation. But, as with all changes, they may require us to alter some long-standing traditions. If so, which is more important, our traditions or the future health and vitality of our rangeland resources?

These ideas may be viewed with alarm by some conservationists. Let me register a disclaimer: they are food for thought. They don't represent the policy of my employer. Nor do they represent the position of the professional societies of which I am a member. Having said that, let's try them on and see how they feel.

Rangelands Are A Multi-Resource Ecosystem

The first idea is to sell the concept that rangelands are more than just livestock forage, wildlife habitat, or any other single resource. They are diverse and productive ecosystems which provide a wealth of different benefits and values to society (Heady 1975). Their soils and waters are the basis for this diversity and for the

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vegetation that can produce so many kinds of benefits for people. Sustaining the production of diverse goods and services means that we must protect rangeland soils and waters, because any significant degradation cuts into our opportunities for the future. But managers have many options for the kinds of vegetative conditions needed to produce the desired resources.

There is no magic "optimum vegetative condition" separate from the goals to protect soils and waters and produce different benefits. The cover types and successional stages on a particular rangeland should reflect the mix of things the owner or manager is trying to produce. Some resources, such as high-quality fisheries, will require that vegetation on riparian and perhaps other sites be managed for late seral stages--climax conditions if you will (Platts 1978). Other resources, such as red meat production or big game forage, may require the maintenance of low- to mid-seral stages on some sites (A.S. Leopold 1966, Heady 1975). A rangeland that is providing a mix of benefits will have a mix of sites, each being managed for different purposes. Obviously, the management prescriptions will vary. After all, Corvettes and Cadillacs both come out of an automobile factory, but the prescriptions for building them are as different as the customers who value them.

If managers push production of one resource to the extreme, or apply one particular management prescription over an entire rangeland something is likely to suffer. The message from the environmental movement of the past two decades is that people want it all. They want a taste of the old west, high quality hunting opportunities, blue ribbon fisheries, lean range-fed beef, a rich and diverse flora and fauna, and tender lamb chops. If that means changing our tradition that rangelands are primarily for livestock grazing, so be it. Let's give the customers what they want, and let them know through aggressive marketing that we've got some great new products. To make that work most effectively we may need to consider changing another tradition as well.

Let The Market System Begin To Replace Regulations

Can you name a single enterprise in this country that invests in producing a multitude of products, sells only one or two, and gives the rest away? If you can, what does their ledger look like? Chances are they are drowning in red ink. Right now a lot of rangeland enterprises, including our government's, are in this position. Some of our laws, regulations, and traditions preclude a rangeland owner or manager from reaping a return on all the products of his or her lands. Granted we are beginning to see some breakthroughs with examples like the Deseret Ranch in Utah (Jones, this proc). Still, few private and virtually no public managers see the direct economic benefits from the water, fish, wildlife, and recreation they produce.

Obviously, not all of the benefits of rangeland management can return revenues. And few people would argue with the need for regulations or tax incentives to deal with resources that cannot be neatly reduced to private property, the so-called common access resources (Hardin and Baden 1977). So, our society has a system of rules and regulations to provide for natural resource benefits that do not have good market systems for allocation (e.g., the Endangered Species Act, and clean air and water laws). But our rangelands are producing a lot of things that are or could be marketed for private consumption. Game wildlife and fish are among the best examples.

Our traditions consider game animals to be free goods from the standpoint of the range manager. Consumers need only pay for the regulation of harvest and research and management conducted by state agencies. Our traditions also once considered trees, water, and forage to be free goods. Now we pay for the right to convert them from public to private property. That provides a pretty good incentive for a manager to emphasize their production.

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things people are willing to pay for. Or it's in tax benefits that shift dollars from the general public to favor specific users. Or it's in political coercion to curtain the emphasis on resources that return revenues. Any way you cut it, nonpaying resources often end up wearing black hats. Perhaps we should no longer shelter our valuable wildlife and fish resources as constraints or welfare benefits. Why not let them compete with other rangeland benefits on the open market? They could easily be among the resources that make an operation fiscally sound.

I am not proposing that water quality, wildlife, fish, and recreation have to be economic resources for conservation to work. And I do not advocate the dismantling of our carefully crafted conservation laws and policies. There are hundreds of examples of good land stewardship without user pay hunting, fishing, or nature observation. That is because a deeply felt land ethic drives many rangeland managers to be good stewards. My concern is that we are missing a great opportunity to help those managers stay in the black (Teer et al. 1983, Thomas 1984, Salwasser et al. 1984). Wildlife, fish, and recreation have high values in our society. People want high-quality fish and wildlife recreational opportunities, and they are willing to pay for them. Maybe its time to change another of our traditions and add a few more rangeland resources to the stock of goods and services that are commonly allocated through a market system.

Of course, there are a lot of procedural and equity matters to resolve in changing this tradition. There's a lot of foot-dragging to overcome too. You can tell the folks who don't want this change by their skill in coming up with an endless array of reasons why it won't work. We would need a bold commitment on the part of the wildlife and fish users and their representatives to make the change and work out the details as they proceed. Groups like Ducks Unlimited, Trout Unlimited, thousands of hunting and fishing club leases, and The Nature Conservancy have proven the conservation benefits of paying for what you want. The adage is true; you do get what you pay for.

A market system for some wildlife and fish resources, coupled with our society's current policies on biological diversity and environmental quality, would not only reap a greater return to the rangeland manager, but we'd have better quality soil, water, and vegetation management as well.

Work It Out Together

A third idea for change is to put decision making and conflict resolution back in the hands of the people most affected by decisions; all the people, not just the original vested interests. We are going through a period when a lot of conservation business is conducted in the legislatures and courts. Perhaps this is necessary as we adjust the balance that is conservation. Will it always be this way? I hope not.

Managers know a lot more now about how to produce different resources from rangelands. They won't ever know it all, but they know enough to do a pretty good job. Land owners and public land managers are increasingly sensitive to the variety of people's concerns about how rangelands are managed. Many rangeland users are quite sophisticated in multiple-use management planning. They know what interdisciplinary teams are and they know how to do Coordinated Resource Management Planning. Maybe we could let the folks who are closest to the issues and have a stake in the outcome develop the course of management. Of course, the success of this would depend on having all interests adequately represented on a particular decision.

We are letting the courts decide too many disputes over rights and compliance with laws and regulations. Any case that goes to court is a signal that the people closest to the issue have failed to find a solution to a problem. I hope all conservationists are as uncomfortable as I am about lawyers and judges making our conservation decisions for us. They are becoming our designated hitters and we are losing the skills and incentives to solve our own problems.

If all parties to a case respect the rights of others and understand that changing long-standing uses and traditions takes time and patience we might be able to get more solutions worked out by conservationists rather than the courts. If we understand that negotiation and compromise are the rules of the game and that no one interest is going to win it all we might be able to keep a few more decisions in the hands of those who stand to lose or gain the most. It will take good faith on all sides and a willingness to give a little. On public rangelands, it will probably also take a change in the focus of decision making from an individual to a group.

There are now many cases where impending confrontations over public rangeland uses were turned into workable solutions through a consensus approach to decision making.

Everyone had to give a little, especially agency line officers who had to yield the "fame and glory" of making the decision as the responsible official. They may still sign the plans, but ownership in the decision is clearly shared. Its never easy to give up power, but the traditional approach to decision making too often includes the fame and glory of defending the decision in court. That usually wastes a lot of time and dollars and rarely results in better land stewardship than could be achieved through a consensus of the interested parties. Maybe we ought to try a little more of the consensus approach to see how widespread and how far up the decision making ladder it will work. It may not work everywhere, but where it does it could be a good alternative to more laws, regulations, or constraints imposed by people a thousand miles from the issue.

We Can Have It All

The title of this paper says we can have it all. I'm convinced that's true. But we may need to change a few things to make it happen. Right now we're not getting all we could from our rangelands. There is still an untapped potential for higher and more diverse production of goods and services. Our customers want this diversity.

And our laws and regulations are more than adequate to support a shift from rangelands tended for livestock production, to rangelands managed as ecosystems for a multitude of benefits. To help drive that shift the people who use and value the different resources from rangelands must begin to pay the producers more fully for the costs of providing those goods and services. This is politically hot, so the mechanisms will probably have to be tailored locally with affected interests deeply involved in making this change. Finally, we must have more faith and confidence in local people and groups to work together for long-term solutions to problems. Those people must respect the rights of all others with interests at stake. More laws and regulations are not good solutions to rangeland conservation.

I am not the only conservationist who suggests these ideas in this volume. Such changes won't be easy. They would have already been made if they were. The stakes are high and long-standing traditions may have to be modified. But rangelands are too valuable, and frankly we're too proud a people, to let the trends continue. In the spirit of Aldo Leopold and Gifford Pinchot, let's do more than just talk about how to increase the benefits of rangeland conservation. Let's build some new traditions that work better than the old ones.

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CAPITALIZING ON RANGE'S OPPORTUNITIES FOR THE FUTURE - A RANGE SCIENTIST'S VIEWPOINT

By Joseph L. Schuster[1]

Range Management in Perspective

Throughout history the United States has had a tendency to group its national trends into segments of 10 years or so. Each decade has had its own identity.

For example, the 1920's are remembered largely as a time of phenomenal growth, gaiety, and initial baptism of the United States in world power politics.

Mention of the 1930's brings memories of hardship, frustration, and a reassessment of domestic economic policy. This decade also spawned the "great conservation movement" and an array of farm programs that lingered far beyond their need.

The 1940's brought another world conflict with its aftershocks and development of a policy of containment as an international strategy.

The quieter 1950's accelerated toward the end with our preparations for space exploration and a national reassessment of educational values.

The soaring, volatile 1960's captured some of the emotional, environmental, and economic moods of earlier times, but the period suffered the spoilage of a futile mission in Southeast Asia and its shock waves of reaction.

The 1970's were a decade of increasing environmental concern, but when this decade should have been a period of comfortable growth in all areas, we ran headlong into new domestic and international issues of considerable magnitude. Our world mechanical machine ran away from its propellant, OPEC (Organization of Petroleum Exporting Countries) was born, and we rediscovered the full meaning of energy and inflation. We took a new look at the farmer and the rancher and leaned anew the value of a marketplace and the meaning of a price mechanism as a governor of buyers and sellers. The Nation was concerned for the first time with basic supply problems--not just in energy but in timber and even food. The food crisis became more serious and widespread than the world had experienced since the 1940's.

Now, we are in the mid-1980's. We are more mature now about conflicts in the name of democracy, but communist activities in Central America and the Middle East are a real concern. Inflation has been brought under control, but a high national debt and the foreign trade deficit threaten continued economic growth. The continuing drought and famine in the Sahelian countries, especially Ethiopia, refocus our attention on food shortages and the effects of desertification due to mismanagement of rangelands throughout the world. The ultimate effects of the current economic crisis in American agriculture will not be known until the next decade.

These events have had far-reaching impacts upon rangelands and range management. Present day range management actually had its beginnings around the turn of the century, but it took the drought and "Dust Bowl" of the 1930's for a real concern for conservation and range management to emerge. Much range management information and technology has been developed and applied in the United States since the great "conservation movement" began 5 decades ago (Dyksterhuis 1972).

The next few decades will bring considerable change in use and, consequently, new technology, to rangeland management. The future will mean more people, more interactions between people, and more pressure on the rangeland resource to provide more goods and services.

Along with more people to feed, there will be an increasing demand for outdoor recreation, offsite water, and many other uses. These pressures, along with environmental concerns, will require more and different management technologies and strategies than exist today. Range managers of

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the 21st century will have to be total resource managers with multidisciplinary tools and interdisciplinary approaches to management and decision making.

Factors Affecting "Use" of Range

Although the demands upon rangelands will continue to intensify, the resource itself will change little, only the "use" will change. Therefore, examining the resource and the factors affecting its use are prerequisites to developing strategies for the future.

The driving forces that will affect rangeland use are an increasing human population and a reduction in the productive land base. Other major influences include the leaner-meat syndrome, increasing affluence, changing land use, increased mineral exploration, an impending water crisis, and the increased demand for wildlife, hunting, recreation, and nontraditional uses.

Major world events that will affect agriculture and range management in the future are: 1) the emergence of agricultural biotechnology, 2) advances in computer technology and applications, 3) a continued rise in energy and mineral costs, 4) increased U.S. dependence on foreign markets and economies, and 5) increased environmental awareness (Joint Counc. 1984). Range can gain by reacting positively to these events and a growing public knowledge of the value of rangeland resources. The spinoffs from biotechnology research and new computer applications must be captured in range resource management. We must also take advantage of the fact that rangelands provide food, wildlife, recreation, and water, and yet range management is one of the least energy-intensive forms of agriculture.

Give Range a National Priority

Dictionary definitions of capitalize include: "to take advantage of, to compute present value (future returns), and to provide capital for." All are germane to the objectives of this conference. Rangeland is the Nation's resource of the future--it is our national reserve, and it has a tremendous present value. In order to meet future needs of water, food, fiber, recreation, and nontraditional uses, rangelands and range conservation should not only become a USDA (U.S. Department of Agriculture) priority but also a national priority. It is essential to the future welfare of the Nation that the national commitment to rangeland resources management and conservation be increased relative to other agricultural programs.

To capitalize range, rangeland conservation and improvement should be given priority status in the national conservation program. Improving rangeland currently in fair to poor condition, which is listed as the fifth objective of the National Program of Soil and Water Conservation (U.S. Dep. Agric. 1982), should be upgraded to a national priority and include all aspects of rangeland management.

Transmit Public Concern Into National Policy

There is a pressing need to transmit the current public concern for soil and water conservation on rangeland into national policy. Our soil and water resources are our nation's wealth. They are the strength of our nation, and their conservation is the responsibility of the landowner. As a nation we must realize that there is a cost for conservation and that the owner (private or public) is not the only beneficiary of rangeland improvement practices. The enhanced environmental quality resulting from conservation practices is generally an offsite public benefit. Therefore, as a nation we must be willing to assist the landowner to apply long-term conservation treatments. We should adopt policies that will provide economic incentives for range conservation by private operators and disincentives for misuse of rangeland.

The "sodbuster" and "conservation reserve" legislation currently being considered are good examples. My plea would be to require that only adapted native perennial species be allowed for plantings in the conservation reserve program. Annuals or introduced species are only temporary fixes.

Recognize Range as a Resource Rather Than a Commodity

Too many laypersons, as well as "range people," relate range management only to livestock use. Livestock grazing is, and will be, the most important use of rangelands for some time. Nonetheless, range management is germane to all products and uses of rangelands. We have allowed range to be narrowly identified as livestock grazing when, in fact, it is a resource with many products and uses. Range management should be identified as total resource management concerned with all products of rangelands.

In nowise should livestock grazing be deemphasized. After all, the ruminant animal is the best way to utilize range forage for production of human food, and grazing is an important component of the range ecosystem. Rangelands are important now as a meat and fiber source but will be even more important in the next century as the demands for food and fiber increase. By the year 2030 the U.S. population will exceed 300 million, yet we expect to lose 7 percent of our rangeland to other uses during that period (Off. Technol. Assess. 1982). The combination of more people to feed and less agricultural land in production will make rangelands the primary base for livestock production. The use of rangeland for wildlife and recreation will continue to increase until food, fiber, and water production preempt them in importance. Consequently, rangeland should be identified as the grazing resource of the future and every effort made to conserve its productivity.

The uniqueness of rangeland and its management as a resource rather than a commodity should be realized when range management programs are formulated. This has not been done in the past, and range has suffered from lack of recognition and program development which it deserves. Here's evidence:

- Manpower and funding commitments to range in both USDA and USDI (U.S. Department of the Interior) continue to decline in relation to those for other natural resources.
- Range received only slight consideration in the Resources Planning Act Alternative Goals 1985 Program; e.g., livestock grazing was not treated as an opportunity area as were timber, wildlife, and recreation (U.S. For. Serv. 1981).
- Most soil and water conservation programs are oriented toward croplands. The current Secretary of Agriculture Memorandum on Range, which implies that rangeland will be put on par with the rest of American agriculture, should be fully implemented.
- There has been no administrative support of the Rangeland Research Act (Subtitle M of 1981 Farm Bill) and the Renewable Resources Extension Act of 1978. Consequently, they have received minimal funding and then only through the efforts of Congress.
- The Soil Conservation Service has placed major emphasis on "conservation tillage" on cropland, but there is no comparable effort in conservation for rangeland. A "conservation management" movement for rangeland is in order.
- Except for special studies, there is no adequate way to identify range inputs and products within USDA. Within the Agricultural Research Service, rangeland is mixed with pasture and forage research. Within the Forest Service, range is lumped with wildlife and fisheries. Within the Current Research Information System (CRIS), range is combined with several other activities rather than as a resource commodity (as forestry is treated).

These and other reasons indicated that range and rangelands should have a separate identity in USDA and be treated as a land resource with several commodities and uses. We have a Forest Service for forestland, a Soil Conservation Service for cropland; why not a Range Service for rangeland? If such a structure is not feasible, range should at least be given divisional status to improve its identity within agencies.

Make a Commitment to Range

We need the commitment that a primary goal of the USDA is to ensure that range achieves truly coequal status with other land resources in our planning process, management decisions, and technical assistance programs. Hope was given to this commitment by then Assistant Secretary of Agriculture Rupert Cutler at the Rangeland Policies for the Future Symposium in 1979 when he made the following statements:

> "Range ecosystems, in my opinion, have too long been treated as 'stepchildren' by Federal - at least USDA - resource agencies. This great and important resource has been neglected when comparing its funding allocation with those of croplands and forestlands and even other natural resource uses such as wildlife and recreation.
>
> The whole schedule of investment and activity in range management must be shifted upwards as promised in the Resources Planning Act, the Federal Land Policy and Management Act, and the Public Rangeland Improvement Act. We cannot accept a federal budget that defaults on the promises of, and dissipates the momentum generated by the passage of these acts. We cannot afford to return to the paralysis of the last thirty-five years that saw our range management agencies frozen - suspended between their fear of reducing allotments and the vain hope that massive public investment in range improvement would make that action unnecessary. We need to work together to boost the Federal range management effort into a high schedule during the next two years. At the same time, present range management agencies such as the Bureau of Land Management, Forest Service, and Soil Conservation Service must take action in reallocation of resources to range within their current, respective budgets."

We need this kind of advocacy now to capitalize on the opportunities range has to provide continued economic health and strength to our nation. The framework for range to assume its rightful place was initiated by the 1979 Secretary of Agriculture Memorandum 1999 and reemphasized by Secretary of Agriculture Memorandum 9500-5 in 1983. We have not seen this commitment materialize fully. However, this conference indicates that the present administration realizes the importance of range and is willing to take the necessary actions. The organizers of this conference, especially the Secretary of Agriculture and Wilson Scaling, Chief of the Soil Conservation Service, are to be commended.

The Range Profession Must Broaden its Leadership Role in Stewardship of Rangelands

Range professionals must seek and accept the responsibility of stewardship of the rangeland resource. We must be recognized as the general managers of this vital resource. The range profession cannot stand back content with only "grazing use" while other commodity groups enjoy public support and increased funding. We must step forward and take our position as the leaders in rangeland resource management.

To do this, range professionals must broaden their concepts and principles of range management. We should become the driving force and the leaders in an interdisciplinary effort in multiple-use management of rangelands. In doing so, we must fully coordinate all uses and disciplines dealing with rangeland resources. We must truly be advocates of the systems approach to range ecosystem management. Our nation can no longer afford several disciplines or commodities going separate competitive ways in managing rangeland resources. Livestock producers, conservationists, recreationists, and environmentalists must join together for the public good in stewardship of this national resource. The Society for Range Management can be a catalytic force in public education and policy formulation for properly utilizing our nation's rangelands and conserving them for future generations.

Capitalize Nonmarket Values

When developing the criteria on cost-effectiveness of range conservation practices USDA and USDI must recognize that benefits of range conservation practices accrue to the public as well as to the landowner. Increased grazing is not the only value derived. In addition to increased forage

production, range improvements 1) enhance fish and wildlife habitat, 2) enhance recreational opportunities, 3) enhance water conservation onsite and both quality and quantity offsite, 4) reduce flood damages, and 5) reduce siltation and sedimentation downstream. All are for the public good, and all should be considered when capitalizing range conservation practices.

Water may soon outrank land as a major constraint to U.S. food production because of the rapid depletion of groundwater reserves in the West, Southwest, and Great Plains. Most of the western agricultural, industrial, and municipal needs are met by runoff from range and forestlands, and they have the potential to provide more. For example, a report issued by the Office of Technology Assessment (1983) cautions Congress that brush encroachment on the nation's rangeland poses a major threat to long-term productivity. Noxious brush and weeds now infest 350 million acres of our nation's rangeland. A 50-percent reduction of these noxious plant infestations could make 12.2 quadrillion gallons of water available each year for other uses and enhance all uses of rangeland.

Capitalize Research, Technical Service, and Education in Range

With the considerable amount of additional pressure that will be placed on American rangelands in the future, it is essential that range research, education, and technical assistance be accelerated. We cannot afford further range deterioration. The productive potential of our nation's rangeland must be maintained where it has not deteriorated and be enhanced where it has. To accomplish this, range research and education must truly become a part of the total U.S. agricultural and natural resource commitment. We must capitalize this resource in proportion to its value to the Nation.

Investment in research focused on range problems and the development of new knowledge is the key. The Rangelands Research Act provides one mechanism for this. It should receive support from all users of range and its efforts be directed at solving range management problems created by the multiple uses of rangelands. Additionally, a portion of the new USDA initiatives in biotechnology should be directed toward range problems.

Most of the breakthroughs in research have come from trying to solve practical problems in society. We must capitalize on this in range and direct our research toward problem solving. Universities can become more relevant by forming more problem-oriented centers within the disciplinary departments, redirecting the mission of the older schools, or developing totally new schools. An example is the proposed establishment of a Center for Ranch Management Research and Education in Texas.

Much can be done towards improving range condition and increasing the renewable rangeland resource outputs through intensive applications of knowledge. New effective methods and processes must be developed to transmit technology into application by education and extension institutions. The extension of knowledge involves not only the delivery but also the adoption and implementation of the information in order for managers to make informed decisions. All federal and state agencies responsible for extension, technical, and financial assistance must coordinate their efforts to improve the packaging of information and its delivery to potential users (Joint Counc. 1984).

We must also capitalize on the intellectual capacity of our agency personnel by providing continuing education programs offering either postgraduate or in-service short courses that foster the development of professionals. This continuing education is critical for meeting the intensified management problems resulting from increased multiple uses of our rangeland resources. An increased knowledge base is an absolute necessity for the continued growth of our range professionals and our agencies.

Develop a Mutual Commitment

We can capitalize on the opportunities for the future, but we must do it through the application of additional knowledge, through thoughtful, long-range planning, and through our mutual

commitment to solving problems, resolving the conflicts, and taking the initiative required in the effort. Our success will depend as much on public education and political action as on scientific effort. Scientists tend to think in terms of scientific and technological solutions. They tend to forget that people, societies, and political systems are the context within which biological systems must work. As professionals in rangeland resource management, we must bridge the gap between biological and social scientists if we are to fully capitalize on the opportunities for range.

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